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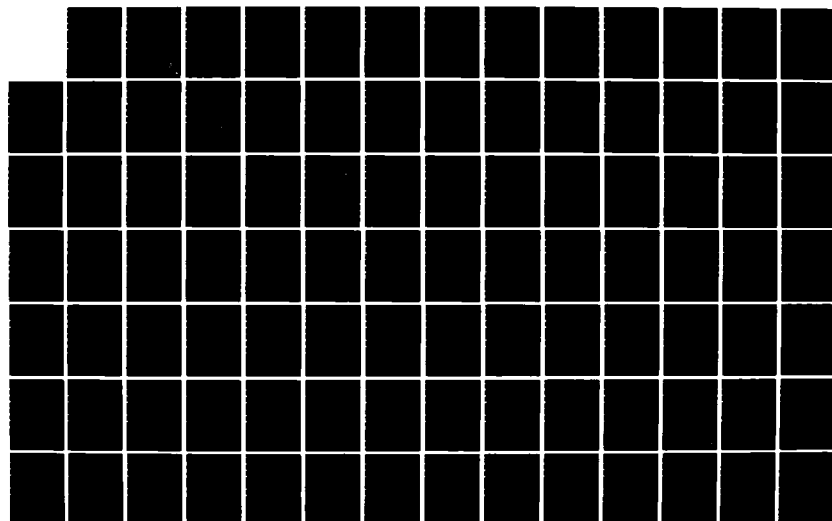
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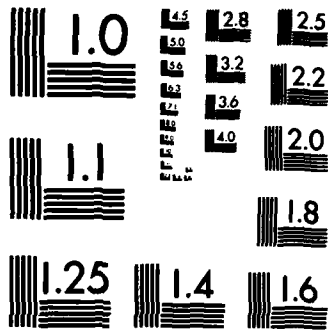
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**Volume I
Summary**

AD-A157 246

**Civil Airlines/Air Services in
Bangladesh, India and Pakistan**

Prepared for

**Defense Intelligence Agency
Washington, D.C.**

Contract No.: MDA 908-84-C-0834

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VOLUME I - SUMMARY REPORT

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1 INTRODUCTION

In accordance with contract No. MDA 908-84-C-0834 a study has been performed for the U.S. Department of Defense, Defense Intelligence Agency (DIA), Washington, D.C. entitled Civil Airlines/Air Services in Bangladesh, India and Pakistan. The overall purpose of this study was to examine the potential capability and capacity of the civil airlines and civil air services of each country to support their country's military forces in the event of conflicts or other national emergencies. The objectives of this study, as outlined in the contract and as discussed with the DIA in a meeting on March 29, 1984 in Washington, D.C., include:

- (a) Inventory of each country's civil airline flight equipment, and its capacity for normal operations,
- (b) Description of civilian airports, personnel, communication systems, and maintenance facilities,
- (c) Organizational, legal and operational framework of each country's airline, its financial resources and future outlook,
- (d) Previous history of the use of civil airlines and other transportation systems during national emergencies,
- (e) Civil airlines and military interface during normal and emergency conditions,
- (f) Review of the capabilities of military aircraft and military airports, and

- (g) Evaluation of the capabilities and the potential use of the civil airlines to serve the needs of the military, if called upon during national emergencies.

The report is divided in four volumes. Volume I is a summary report which provides an overview of the capacity and capabilities of each country's civil and military airlines, including flight equipment, airport data, personnel information and level of training, maintenance capabilities, future planned acquisitions, and a brief description of each country's military aircraft and military airports. Based on the publicly available data, the potential use of the civil airlines is evaluated and their operating environments are reviewed to determine the civil airlines' capabilities to serve the needs of the military during emergencies. Bangladesh, India and Pakistan are discussed individually and in more detail in volumes II, III, and IV, respectively. These volumes present available factual data including an inventory of aircraft, list of airports, staff categories and their training requirements, communication systems, maintenance facilities and a brief assessment of the potential use of the civil airlines during national emergencies. For the purpose of this study, civil airlines are considered those publicly owned and operated country airlines which provide non-military passenger and cargo transportation. Figure 1.1 presents the location of Bangladesh, India and Pakistan.

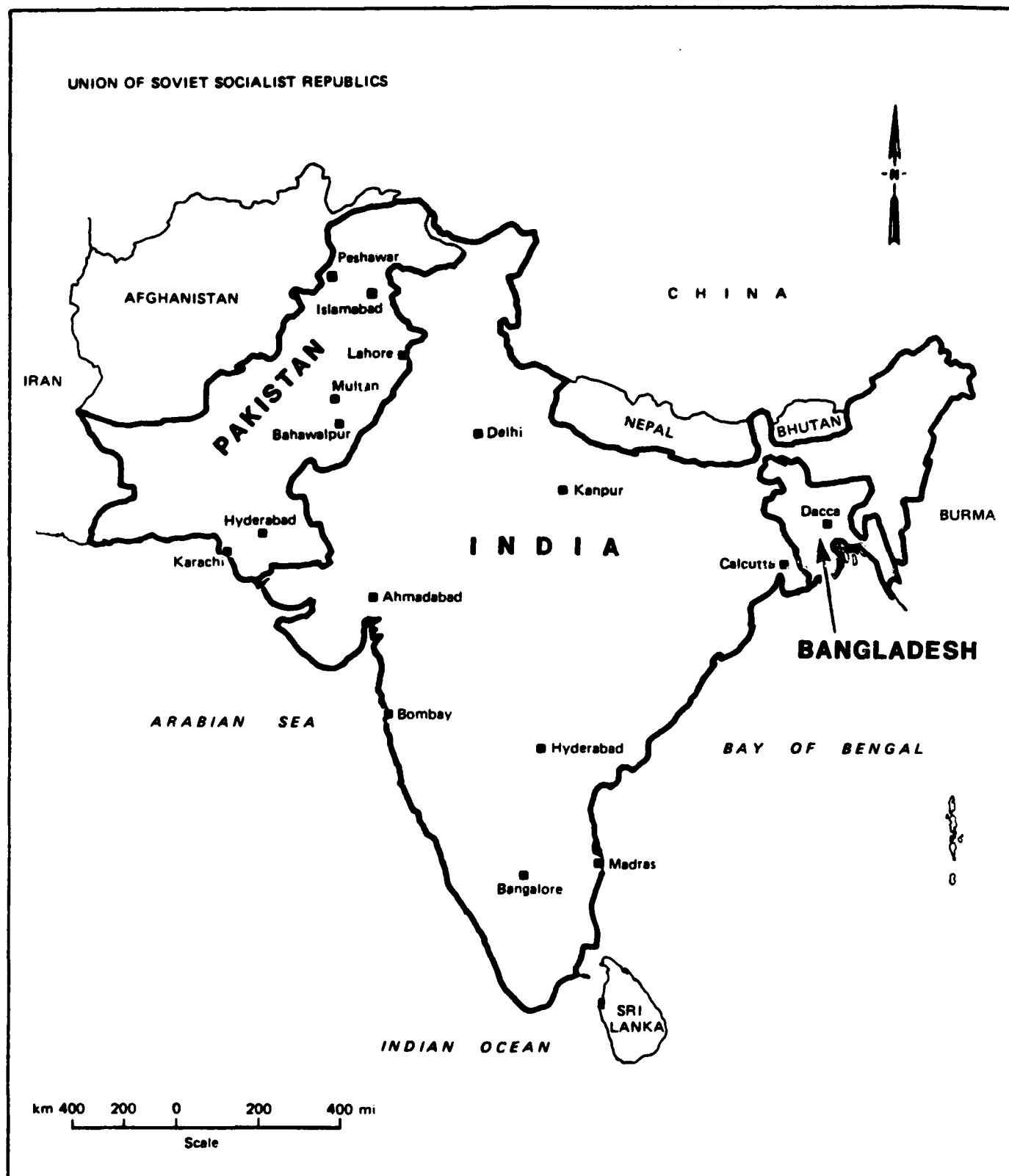


Figure 1.1 — LOCATION MAP
Bangladesh, India and Pakistan

2 RESEARCH METHODOLOGY

The research methodology used in this study (Figure 2.1) is divided into the following five tasks:

- i) Identify Study Parameters
- ii) Define Data Needs
- iii) Collect Data
- iv) Analyze Capabilities
- v) Evaluate Potential for Future Use.

i) Identify Study Parameters

The scope of work as defined in the solicitations and in the contract was used as a base document for identifying the study parameters. Discussion with the DIA on the objectives and scope of work supplemented the understanding of this task. The project team's knowledge of the use of civil aviation in Bangladesh, India and Pakistan during normal and emergency conditions also aided in identifying the study parameters. These study parameters included:

- Historical perspective and the physical environment in which each airline operates
- Status of airfields and their capability to support military operations
- Condition of fleet and its convertibility for military use
- Personnel strength and the quality of training provided
- Communication networks and their reliability

- Quality of maintenance and indigenous capability
- Command, control and communications during emergencies
- Future aircraft fleet acquisitions and airport development plans, and
- Assessment of the potential use of the civil airline during future natural and war emergencies

ii) Define Data Needs

The research team defined the data needs to satisfy the objectives of the study using DIA's letter U-25-029 dated April 23, 1984 as a guideline. The data needs identified in this task included (a) current information on civil aircrafts and airports, personnel categories, ground and in-flight communication systems, and the location and capabilities of maintenance facilities; (b) historical data on the past use of civil airlines during national emergencies; (c) details of future acquisition plans; and (d) data on military aircraft and airports. All this data was used in the evaluation and assessment of civil aviation's ability to support each country's military forces during national emergencies. Completeness and accuracy of data was considered to be of prime importance in Task (ii).

iii) Collect Data

Based on an understanding of Tasks (i) and (ii), the research team identified a number of publicly available primary and secondary data sources for data collection. The primary data sources have included civil aviation publications, trade

journals, local newspapers (in native and in English languages), official reports and publications of each country's Government and airline publications, aircraft manufacturer market reports, and interviews with knowledgeable individuals from each country now living in the USA or in Canada who were involved in some way with the operations, maintenance or emergency situations of the civil airlines under study. Some of the specific data sources have included in relevant articles Aviation Week and Space Technology; Market Intelligence Reports from major aircraft manufacturers and Defense Marketing Services; several ICAO's publications including Enroute supplements, Digest of Statistics, General Airport Data, Aircraft Personnel Training Data and Civil Aircrafts on Register; McDonnell Douglas Outlook for Commercial Aircrafts; World Aviation Directory; Publications of Air India, Indian Airlines and Pakistan International Airlines; Jane's All the World Aircrafts; World Bank Studies; and U.S. Dept. of State's background notes on India, Pakistan and Bangladesh. Native and English language newspapers used as data sources include Sangbad for Bangladesh; Amarita Patrica, Ananda Bazar Patrica, Times of India; Statesman, The Hindustan Times, and Nai Dunya for India, and Dawn, Imroz, Jung, Pakistan Times, Mashrig and Nawa-e-Vaqt for Pakistan. The research team has studied a total of 300 primary, 75 secondary and about 25 native language newspapers during the course of the study. The secondary data sources have included United Nations aid records, university theses, aircraft manufacturer's specifications, ICAO's training requirements for various civil airline categories, and unclassified FBI reports. The local newspaper studies focused on the dates of the border conflicts and wars between India and Pakistan in 1947-1948, in 1965, and in 1971; between India and China in 1962; and the times of major national disasters. During the data collection phase, several data gaps were identified in the publicly available literature and the

information was supplemented by personal interviews from about 40 individuals. Information collected from one source was cross checked with another for accuracy and completeness.

iv) Analyze Capabilities

An analysis of the capabilities of civil aviation operations, as presented in the report, is based on (a) available data as collected in Task (iii), (b) the project team's knowledge of civil airlines (c) interviews with people who have knowledge of the capabilities and the operating efficiencies of civil aviation operations in Bangladesh, India and Pakistan, and (d) discussions with several outside consultants hired by the project team to fill specific data gaps.

The review of local newspapers revealed little direct information on the use of civil aviation for military purposes. During the wars of 1962, 1965, and 1971 civil aviation, including foreign airline operations, was disrupted or stopped completely due to fuel shortage, non-operation of navigational aids at the airports, and the danger of civil aircraft being caught in aerial warfare. During natural emergencies, each country has used military aircraft and helicopters to drop relief goods and medical supplies into the affected areas. Local newspapers have generally not covered the use of civilian aircrafts for mass troop or equipment and artillery movements. Such movements were considered too sensitive from a military strategy point of view to be mentioned in public newspapers. Therefore, the research team has mainly relied on the information provided by the project consultants and the team's own experience to analyze data and evaluate the use of civil airlines for military purposes.

v) Evaluate Potential for Future Use

The data analysis in Task (iv) formed the basis for developing potential use of civil airlines for military purposes as described in Section 4.2 for Bangladesh, 5.2 for India and 6.2 for Pakistan.

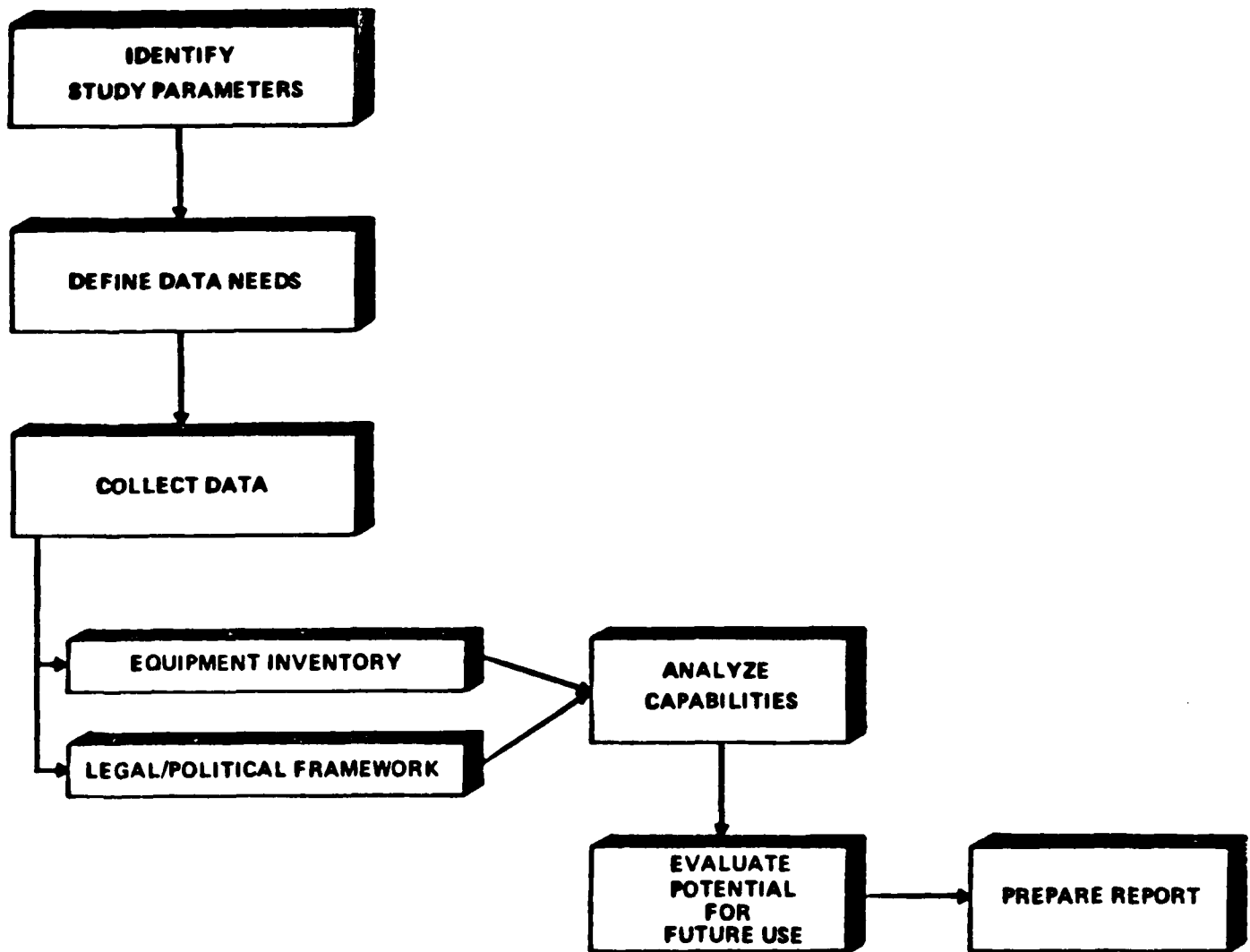


Figure 2.1 RESEARCH METHODOLOGY

3 LIMITATIONS OF THE STUDY

The contract scope of work has required the use of open source material only with no field research in Bangladesh, India or Pakistan. The project team has found limited publicly available information for the countries of study in the United States in the areas of personnel training, communication systems, maintenance facilities, future outlook of civil aviation, and civil and military interface during national emergencies.

Traditionally, the Government and the semi-Government departments to which civil airlines belong keep their activities to themselves; information stays buried in inter-departmental memos and Government files. Evaluation type information rarely gets published in outside journals. For example, the few articles published by the Indian Institute of Management on civil aviation are generic in nature. Bangladesh is a member of ICAO but there is no resident representative, and a search in the ICAO library revealed either very old (8 years or more) or very little directly applicable information on Bangladesh civil aviation. Similarly, major data gaps were found in publicly available information for Pakistan civil aviation. Moreover, specific questions from outsiders about the capabilities and capacities of civil aviation in the countries of study generally arouse suspicion in the minds of Government or civil airline officials and simple acts like taking a picture of an airport or from the air are not permitted.

The project team was able to fill several information data gaps by using consultants knowledgeable in civil aviation matters of these countries. The team also interviewed ex-airline and ex-military personnel living in the USA but their information, in several instances, was also found to be several years old.

The study shows that historically, civil aviation resources have supplemented the military's troop and equipment carrying capabilities, but in real life situations, other modes of transportation were used extensively as well. For example, railways have been widely used in India and Pakistan, and boats have been used in Bangladesh in previous wars and major national emergencies. This study has briefly described these transportation resources. While some of the data may be sufficient for the purposes of this study, a more accurate assessment would require field studies, a capability update, and additional research that was not a part of this study.

4. BANGLADESH AIR SERVICES

4.1 OVERVIEW, CAPACITY AND CAPABILITY

4.1.1 Civil Airlines/Air Services

4.1.1.1 Bangladesh Biman

The civil airline of Bangladesh is Bangladesh Biman. Since its formation in 1972, Bangladesh Biman is the sole operator of commercial air transport in the country. It has a total of 15 aircraft including six Boeing 707s, six Fokkers and three McDonnell Douglas DC-10s. The Boeings, Fokkers and DC-10s are on an average 18, 14 and 6 years old respectively; most were purchased second hand from other airlines.

Bangladesh Biman has limited maintenance facilities and currently relies on airlines located outside of the country, such as Pan American and Singapore Airlines, for the maintenance of its fleet. Bangladesh Biman is reported to have problems in timely procurement of spare parts, which could reduce its operational efficiency during national emergencies.

The communication facilities are reported to be in the form of telephone, teleprinter, mobile units, radio communications and aeronautical communications. These services have operated at less than optimal level in the past, but Bangladesh is trying, through aid and assistance from various countries, to improve in-country and international communications which will help information in emergencies.

Financially, Bangladesh Biman is reported to have been losing money for the last several years and faced

severe problems in securing favorable financing for spare parts and fleet replacement in the past. Bangladesh Biman has now secured some long term loans from Bank of China and from foreign resident banks representing Middle Eastern interests on terms and conditions reportedly favorable to the lenders. So far, the airline has had problems in securing loans U.S. or from European sources. For any fleet expansion, the issue of financing will set the direction as to which aircraft Bangladesh Biman will buy in the future.

Legally, Bangladesh Biman is a public corporation and operates under direct Government control. The use of Bangladesh Biman resources for military purposes during national emergencies poses no legal problem. Such use will always take precedence over any civilian commercial use of the aircraft or civil aviation facilities.

Table 4.1 presents a list of the aircraft operated by the Bangladesh Biman.

4.1.1.2 Airports

There are nine civil and military combined airports currently operational in Bangladesh. These airports are located at Dacca, Chittagong, Jessore, Sylhet, Comilla, Ishurdi, Thakurgaon, Saidpur and Cox's Bazaar. Except at Dacca and Chittagong, all other airports are reported to lack night landing facilities and offer limited fuel, ground operation and communication facilities, which restricts their use to daytime and fair weather conditions only. Large aircraft landing facilities are available at Dacca and Chittagong airports and on the remaining airports; only smaller aircraft could land at the remaining airports. This prohibits their use for any speedy mass troop movements utilizing large aircraft. Figure 4.1 presents the location of Bangladesh Airports.

4.1.1.3 Personnel

Bangladesh Biman does not employ a large number of ex-military personnel; it is a young country and there are few retired military personnel available to work for the airline. The airline staff is predominantly young and recruited directly. The total Bangladesh Biman staff is about 4500; 70 percent is administrative and support staff. This large concentration of non-technical staff introduces some inefficiency in the operation. The top management of Bangladesh is mostly civilian, although a few retired Army and Air Force personnel occupy lower management positions in the airline operation. The civil aviation training facilities available to the Bangladesh Biman are limited to the equipment on hand. Training is limited to the maintenance of normal operations; the entire training appears to be geared toward peace time operations.

4.1.1.4 Other Civilian Aircrafts

In addition to Bangladesh Biman, other civilian aircraft resources of the country include 16 single-engine aircraft owned and operated by the Government of Bangladesh and four aircraft owned by the Flying Club at Dacca. All these aircraft are small and could carry only a few passengers. Their military use is limited to carrying two to four people or delivering messages short distances. Table 4.2 presents a list of these aircraft.

4.1.2 Military Aircrafts

4.1.2.1 Air Wing - Bangladesh Defense Force

The Air Wing of Bangladesh Defense Force has 26 combat aircraft and 3,000 personnel, all volunteers. The Air Force

Wing has one interceptor squadron with the survivors of nine Russian built single-seat Mikoyan-Gurevich MiG-21MF fighters and two two-seat MiG-21U trainers. In addition, Bangladesh has two fighter/ground attack squadrons with the survivors of 36 J-6 fighters acquired from the People's Republic of China. The Air Wing Squadrons are based at Tezgaon, Dacca, and Jessore.

The remaining Air Force strength is comprised of transport aircraft, utility helicopters and trainers. Bangladesh has only one transport squadron which consists of four Russian Antonov An-12, one Antonov An-24, and three An-26 aircraft. The helicopter squadron operates Russian equipment, such as Mil Mi-4 and Mil Mi-8 helicopters, as well as U.S. built Bell Model 212 and French Aerospatiale Alouette III helicopters which were acquired from India.

It is reported that the operating efficiency of the Bangladesh Air Force is hampered by non-availability of spare parts, most of which come from the U.S.S.R. For the last few years the country has been leaning towards China for the supply of equipment. The Bangladesh Air Force already has a number of China built J-6 fighters and its problem of spare parts availability is expected to improve in the future.

A list of Bangladesh Air Force equipment is presented on Table 4.3.

4.1.3 Other Transportation Systems

Other modes of transportation in Bangladesh include transportation by water (boats) and by land (railways, buses and trucks). Water transportation accounts for about 75 percent of the movement of goods and people in Bangladesh. The extent of inland navigable waterways is about 5,000 miles; 65

percent could be used throughout the year. Regular river steamer services operate along 50 percent of the navigable waters. The other principal means of water transport include motor launches, ferryboats, barges and country boats. Bangladesh also has a small merchant marine comprised of cargo ships. Water transportation is expected to play a major role during any national or war emergency as several parts of the country are accessible only by water, particularly during bad weather.

The second most important mode of transportation is the Bangladesh Railway System. There are currently about 1800 miles of railway track that cross about 3,600 bridges. There are approximately 470 railway stations located in fifteen of the nineteen districts of Bangladesh. About 70 percent of the railway route is meter gauge; the remainder is broad gauge and lies in the western part of the state. Most of the railway lines in Bangladesh run north-south, parallel to the river system. Many freight and passenger journeys include a combination of railway and water transport. Bangladesh Railway operates about 1,200 passenger and 21,000 freight cars. The system is capable of handling 1,000 million freight ton-miles and 2 billion passenger-miles per year. During national or war emergencies, the railways offer a comparatively cheap mode of mass troop and heavy equipment transportation for the military.

The major road system of Bangladesh is about 2,500 miles. Additionally there are about 1,500 miles of unpaved roads and several thousand miles of smaller roads that crisscross the countryside. Most of the roads in Bangladesh require constant maintenance. During floods and heavy rains the roads either erode or break off at the flood water crossings. The local bus and truck transport companies in Bangladesh generally work with

a high profit motive and use their equipment to the maximum, with little regard for normal maintenance. Therefore the long term reliability of buses and trucks during national or war emergencies is expected to be low.

Figure 4.2 presents the principal Railway and Road System of Bangladesh.

4.2 POTENTIAL USE OF CIVIL AIRLINES FOR MILITARY PURPOSES

Civil aviation could be called upon to collaborate with the military in providing assistance during national disasters, handling major internal disturbances and extending help and cooperation if the security of the country is threatened by internal or external elements. The nature of the assistance may include the use of civilian aircraft for a speedy mass movement of troops and light equipment; transportation of arms and ammunition; transfer of wounded soldiers from the battlefields; and carrying of medical and other essential supplies as the situation may demand. The military is expected to evaluate and use its own resources in an emergency situation before calling upon the resources of civil aviation, unless the use of civil aircraft offers a strategic or economic advantage.

At the present time the Air Wing of Bangladesh Defense Force has four Antonov An-12, one An-24, three An-26 and one DC-6 transport aircraft. These aircrafts are supplemented by four Mil Mi-4, six Mil Mi-8, five Bell-206 and six Bell-212 helicopters. The military's combined transport capability is vested in its nine transport aircraft which could be utilized as follows:

An-12: Medium transport, crew of six and up to 100 paratroopers or 44,092 lbs. of freight in the cabin.

An-24: Utility freight transport, crew of five and up to 12,566 lbs. of freight in the cabin.

An-26: Short range transport, crew of five and up to 40 troops or 12,125 lbs. of freight in the cabin.

DC-6: Medium transport, crew of four and up to 74 troops or 12,247 lbs. of freight in the cabin.

If the Bangladesh military depend solely on their own transport aircraft for mass movement of troops, armaments, and equipment, their transport capabilities appear to be restricted. Civil aviation, within limitations and, depending on the specific situation, could greatly increase the military's ability to move men and equipment during emergency. Table 4.4 presents a comparison of the carrying capacities of the military transport and civil aircraft of Bangladesh.

The use of civilian aircraft for military transport is a viable alternative for a speedy movement of troops and equipment, but there are several elements that impose a limitation on the use of civil aviation for military purposes. These include:

(a) Physical Environment: Most of the land in Bangladesh is composed of flat alluvial plains crisscrossed by a number of major rivers and their tributaries which flow south towards the Bay of Bengal. During the monsoon season, winds from the Bay develop as cyclones loaded with rain and blow inland at high velocities, resulting in heavy precipitation and flooding. Several airports are inundated; take offs and landings of civil and military aircraft become difficult or impossible during this season.

(b) Training: The training facilities available at Bangladesh Biman are very meager and staff training is confined to handling available equipment. The staff is therefore capable of handling only routine operational problems. So far, Bangladesh Biman staff has had no actual experience in any war emergency and there is no indication in the publicly available information that such training has been provided. Most of the Bangladesh Biman staff is reported to be directly recruited; therefore they are not expected to have previous training in emergency operations as would ex-Air Force personnel working with civilian airlines. Bangladesh Biman is a bureaucratic organization and its lower ranks may lack the discipline needed for a speedy response essential for the success of operations, particularly during the early stages of a war.

(c) Availability of Spare Parts: The problem of a timely procurement of spare parts for Bangladesh Biman is expected to continue as long as the airline is running at a loss and financing is difficult to obtain. The delay or the non-availability of spare parts may impact the operational effectiveness of the civilian aircraft for military purposes.

(d) Civil/Military Interface: The Air Wing of Bangladesh Defense Force and the Bangladesh Biman operate in two distinct modes of operation and areas of responsibility. Provisions for training across each others functional boundaries could not be ascertained from public sources. The military will have the decision making role during a war emergency. It is expected that the civilian administrative structure of the airline will remain intact but the flow of action items may not be smooth due to the different operating environments of the two organizations.

Simple conversion of aircraft for military use, condition of flight equipment, ground communications, and the use of

civil airfields for military purposes are not considered to be major problems for the military use of the airline.

Overall, the present civil aviation resources of Bangladesh appear to be capable of augmenting military needs in a limited way during war emergencies.

Table 4.1

BANGLADESH BIMAN AIRLINES FLEET

<u>Type</u>	<u>Serial No.</u>	<u>Date of Manufacturer</u>	<u>Date of Delivery¹ To This Operator</u>
Boeing 707-351C	19168	7/66	12/73
	19434	13/67	2/77
	19776	7/68	9/78
	18921	8/65	8/80
	-321B 20018	11/68	1/82
	-369C 20085	11/68	1/82
Fokker F27-600	10438	6/70	9/72
	10453	2/71	9/72
	10477	2/72	10/73
	10442	9/70	11/73
	F28-4000 11172	7/81	9/81
	11180	9/81	10/81
MDD DC-10-30	46993	11/78	8/83
	46995	4/79	9/83
	47817	11/83	1/84

¹ Date of delivery includes lease of equipment prior to purchase date.

TABLE 4.2 BANGLADESH GOVERNMENT AND FLYING CLUB FLEET

Type	Serial No.	Date of Manufacturer	Date of Delivery To This Operator
<u>Bangladesh Government Fleet</u>			
(8) DHC-2 Beaver		(Unknown)	
(2) Grumman G-44			
(4) Fletcher FU-24-950			
(1) Pilatus PC-6/BI-H2			
(1) Piaggio P 166L-2			
<u>Bangladesh Flying Club</u>			
Grumman G-44A	1451	(Unknown)	
Cessna 150D	60490		
150G	65761		
182F	54986		

TABLE 4.3 BANGLADESH DEFENSE FORCE AIR WING FLIGHT EQUIPMENT

Name and Number or Aircraft	Type	Made In	Quantity
<u>Attack, Fighter, Reconnaissance Aircraft</u>			
Mikoyan MiG-21 MF	Fighter	USSR	5
Shenyang J-6/FT-6	Attack/ Reconnaissance	China	30
<u>Transport Aircraft</u>			
Antonov An-12 Cub		USSR	4
Antonov An-24		USSR	1
Antonov An-26 Curl T		USSR	3
Douglas DC-6		USA	1
<u>Trainer Aircraft</u>			
Fouga CM.170 Magister		FRANCE	8
Mikoyan MiG-21UM		USSR	2
Shenyang BT-6		China	12
<u>Helicopters</u>			
Aerospatiale SA.316B Alouette III		France	4*
Bell-206L		USA	5
Bell-212		USA	6
Mil Mi-4 Hound		USSR	4
Mil Mi-8		USSR	6

*May not be in service.

TABLE 4.4 MILITARY TRANSPORT AND CIVILIAN AIRCRAFTS OF BANGLADESH

Name of Aircraft	Number of Aircraft	Passenger Capacity	Freight Capacity (lbs.)	Minimum Runway Requirements (ft.)	Range (miles)	Maximum Speed (mph)
<u>Military Transport Aircrafts</u>						
Antonov An-12 Cub	4	100 Paratroops or 44,092		-	2,237	482
Antonov An-24	1		12,566	-	397	280
Antonov An-26 Curl T	3	40 Troops or	12,125	-	684	280
Douglas DC-6	1	74 Troops or	27,000	-	4,610	356
<u>Bangladesh Biman Aircraft</u>						
Boeing 707	6	189	96,000	8,000	4,235-6,160	535
Fokker F27-600	4	48	14,193	2,310	1,197	302
Fokker F28	2	85	17,000	5,200	1,125	523
MDD DC-10-30	3	380	106,550	5,350	4,000	-

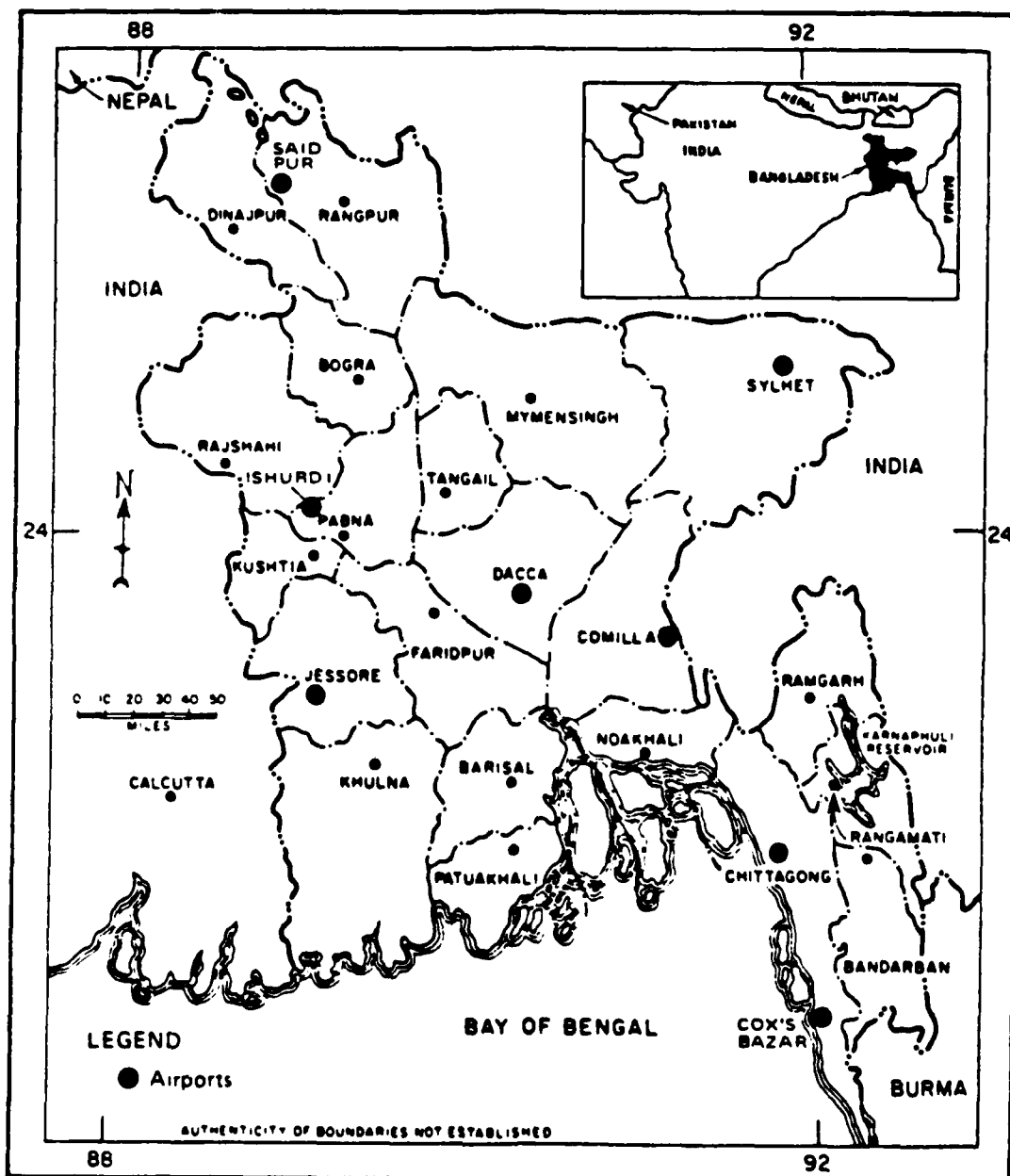


Figure 4.1. LOCAL AIRPORTS—BANGLADESH BIMAN

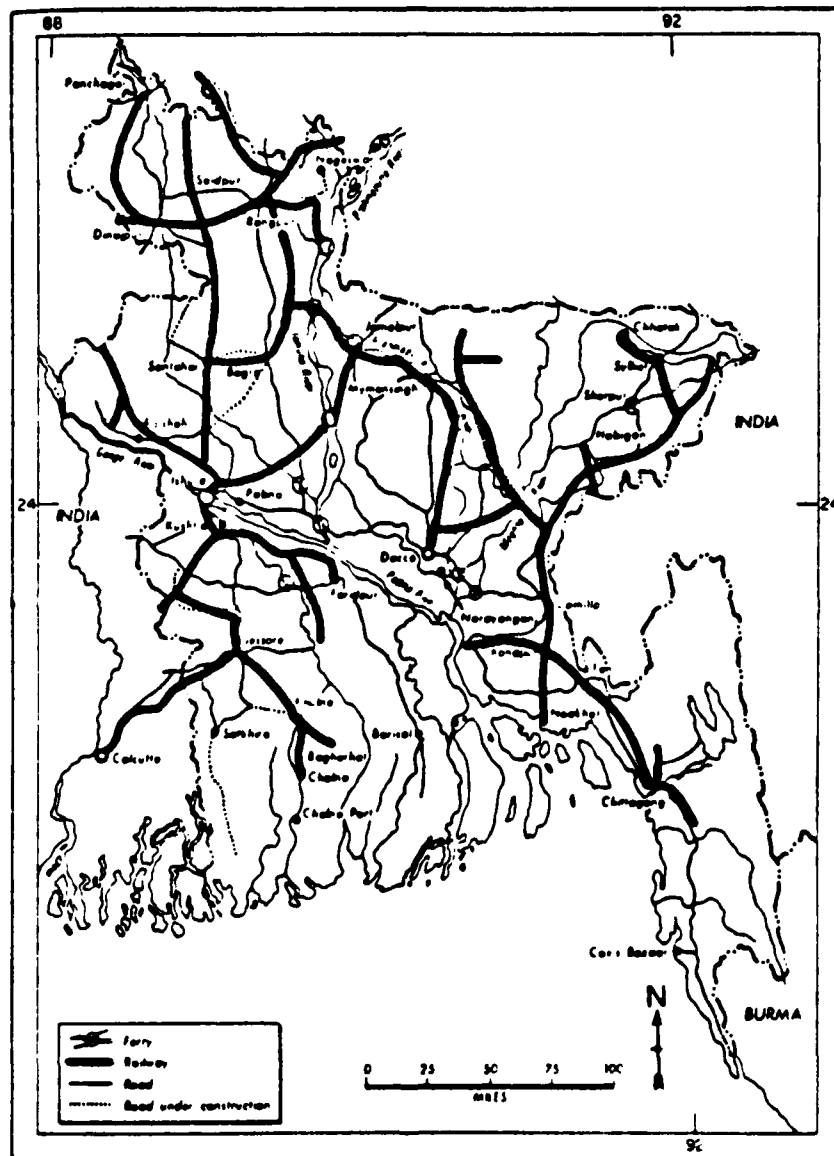


Figure 4.2. BANGLADESH, PRINCIPAL RAILWAY AND ROADS

5 INDIA AIR SERVICES

5.1 OVERVIEW, CAPACITY AND CAPABILITY

5.1.1 Civil Airlines/Air Services

5.1.1.1 Air India and Indian Airlines

Soon after India became a sovereign nation in 1947, the Government, foreseeing the need to make best use of available air travel resources and realizing the potential of international travel, established Air India as a civil airline in 1948. The Government nationalized civil aviation in 1953 and formed two corporations. Air India Corporation serves the need for long distance international travel as the country's flag carrier, and Indian Airline Corporation provides domestic air travel and travel to neighboring countries.

Air India operates a total of fourteen aircraft which include one Boeing 707, ten Boeing 747s and three Airbuses. Except for the 707, which is about 14 years old, the Air India fleet is comparatively new; six of the 747s are about six years old and the Airbuses are about two years old. Air India is self sufficient in maintenance capabilities and, because all of its aircraft operate on international routes, they are reported to be well maintained aircraft and are expected to be reliable and dependable during war emergencies. The Air India Fleet is presented in Table 5.1.

Indian Airlines has a fleet of fifty-five aircraft which include twenty-five Boeing 737s, twelve Hawker Siddeley-748s, ten Airbuses, and eight Fokker-27. The oldest aircraft in the Indian Airlines fleet are the Fokkers and HS-748s, some of which are 18 years old, followed by B-737s which are 14 years

old and the Airbuses, about 8 years old. The maintenance record of Indian Airlines is average-to-good, and it is reported that all safety related checks are performed routinely on all Indian Airlines aircraft. Table 5.2 presents the fleet of the Indian Airlines.

Both airlines, Air India and Indian Airlines, are entirely self sufficient in their engineering and maintenance facilities. Air India's major maintenance base is located at Bombay and is provided with hangars equipped to handle maintenance work of the entire fleet including complete overhauls and repairs of mainframes and jet engines, structural modifications of wide body aircraft, and repair of major components including accessories, avionics and flight instruments. Indian Airlines performs all its maintenance in-house at their facilities located at Delhi, Bombay, Calcutta and Hyderabad. Indian civil airlines are fully capable of performing major conversions needed to convert civilian aircraft for military use during any emergency. In the past the maintenance staff has shown innovation in solving difficult or extraordinary maintenance and overhaul problems. Both of these airlines perform their maintenance functions without any foreign assistance.

Procurement of spare parts is not a major problem for Air India and Indian Airlines. Intermittent delays in spare parts procurement do occur, but it is reported that the delays never hamper either the safety or the operational abilities of the aircraft. Although spare parts for the aircraft are not a problem at the present time, India has to depend on foreign aircraft manufacturers to keep supplying spare parts for a sustained operation. If political or Government pressures caused the suppliers to delay or deny the supply of spare parts, the operational safety and performance of the aircraft during wars could be seriously impacted.

India offers an extensive communication network which covers the entire country. This system is used during peacetime and has been extensively used during emergencies. The various elements of the system include telephone, teleprinter, single select band radio, aeronautical fix telecommunications, mobile units, wireless, microwave and courier communications networks. A majority of the airports have telephone, telex and teleprinter services which are used during normal as well as during war emergencies. The various aircraft operated by Air India and by Indian Airlines offer standard communication equipment on board where as the major airports have visual and electronic navigational aids in varying combinations. The smaller airports, depending on their size and traffic volume, offer fewer navigational aids and other communication facilities which could pose a problem if these airports are used extensively during war emergencies.

The civil airline's training requirements for pilots and other operational staff are very stringent. Training is provided on the ground using simulators and in the air in the aircraft. Part of the pilot training is performed at Indian Air Force schools. Thus provides an opportunity for civilian pilots to experience some of the military operations. Specialized training, including the handling of emergency on-board situations, is provided before the pilot is permitted to fly a particular aircraft independently. Therefore the Indian pilots are expected to perform well during war emergencies.

Air India and Indian Airlines are both on sound financial footing and are running in a profit mode. Financing for expansion of the fleets is not a problem. Air India is planning a fleet expansion by acquiring several Boeing 767s or Airbus A300s. Indian Airlines is expected to order three

Airbuses and five Boeing 757s in the near future. Although fuel economy, the use of existing runways, and favorable financing terms are considered important, political rather than economic considerations play the decisive role in aircraft acquisition decisions, as both the airlines are Government controlled.

The Government maintains a close control over the operations of both Air India and Indian Airlines. The Minister of Transportation and Aviation appoints corporate board members and the Chairman of the Board for both airlines, and he remains closely associated with the decision making of both airlines. Thus, the Government of India can undertake any air transport service or other activity that the airline corporation has power to undertake or can discontinue or change any scheduled air transport service or other activity that the airline is operating. The use of civil airlines during emergencies in India has never been a legal problem. Under any national emergency condition, civil aviation is considered an essential service and emergency use, under Government direction, takes precedence over all other airline operations.

5.1.1.2 Airports

Figure 5.1 and Table 5.6 present the locations and a list of civilian airports in India. The major international airports are located at Bombay, Delhi, Calcutta and Madras. These are used by Air India and Indian Airlines as well as by several foreign airlines that make stops at these airports. These international airports and several others located at major Indian cities offer asphalt runways, ICAO-approved threshold markings, touchdown and center lines, side stops, and designation numbers as well as approach limiting, edge, and end

high intensity lights for night landings. These airports also have all significant obstructions marked and lighted. Major airports have all grades of fuel available, and the facilities to carry out routine maintenance and aircraft checks are available at these airports. Fire fighting, cargo handling, and medical facilities are also available at these airports and they offer adequate essential facilities and services for airline operations. About 20 percent of the airports in India are major airports. The other airports shown on Figure 5.1 represent smaller airports which have limited facilities and fuel availability. Within their physical limitations, all civil airports in India could handle military aircraft.

5.1.1.3 Personnel

Air India employs a total of 17,500 personnel (including 300 pilots) and Indian Airlines has about 19,000 personnel (including 500 pilots). According to one source, 40 percent of the Air India and Indian Airlines pilots are ex-Air Force employees. If civil airlines were used for military purposes, these pilots would be very important resources for an effective transition and successful operation. The level of training of other airline employees such as flight engineers, radio operators, navigators, maintenance and overhaul staff is sophisticated. It is estimated that 30 percent of these personnel have some military experience that will be useful in a war emergency. There are several high ranking military personnel on the Board of Directors and in the management of Air India and Indian Airlines who will facilitate a smooth civil/military interface during war emergencies.

5.1.1.4 Other Civilian Aircraft

Other major civil aviation resources in India include subsidiary airlines of Air India and Indian Airlines. Air

India Charters is a subsidiary of Air India that operates between India and the United Kingdom and uses a leased Boeing 707 aircraft and crew from Air India. Vayudoot is a subsidiary of Indian Airlines which provides a feeder service to eastern and southwestern parts of India. Vayudoot uses two Fokker F27s and a HS748 aircraft which are leased from Indian Airlines. These subsidiaries do not have separate support or training facilities and use their parent companies' resources for their operations. Although the chances are remote that these airlines will be used during any national emergency, they do offer a familiarity of terrain and a knowledge of local operating conditions that may be useful to the military during war emergencies.

According to a recent news item, the Government of India and German aircraft firm Dornier have signed a contract to license production of about 150 Dornier Do 228-200 aircraft in India during the next 10 years. These aircraft will be operated by Vayudoot, Indian Coast Guard, Navy, Air Force, and Indian Civil Aviation Department. Vayudoot will use the aircraft to replace Fokker F-27s and HS748s. The Dornier could carry 19 passengers and fly a stage length of 474 nautical miles. These aircraft will be built at Hindustan Aeronautics and delivery of the first aircraft to Vayudoot is expected in late 1985.

5.1.2 Military Aircraft

5.1.2.1 Indian Air Force

Indian Air Force (IAF) is one of the most powerful air forces in Asia. The IAF has about 635 combat aircraft and employs 113,000 personnel. The air defense of the country rests with 20 squadrons; 14 are equipped with various versions of Russian MiG 21s, four with Folland Gnat FMK1, and two with the HAL

Ajeet. For offensive functions, IAF has 11 fighter-ground attack squadrons equipped with Sukhoi SU-7BM, Hawker Hunter FMK56, HAL Marut MK1 and SEPECAT Jaguar. These squadrons are supplemented by four light bomber squadrons and two tactical reconnaissance squadrons using Canberra PRMK57 and MiG-25R aircraft.

The IAF's transport capabilities rest with 10 transport squadrons: two have Fairchild C-119G aircraft (being replaced by Antonov An-32s); three have Douglas C-47s (also being replaced by An-32s), two have Antonov An-12s; two have de Havilland Canada DHC-3 Otters; and one is equipped with Havilland Canada DHC-4 Caribou aircraft. The IAF has one communication and two liaison aircraft equipped with BAe HS748 twin-turboprop aircraft. The IAF has eight helicopter squadrons that could be used for transport, observation, and as light attack units.

In the last few years a shift has been observed in the IAF equipment acquisition strategy from a reliance on the Soviet Union to the western countries. The Jaguar is already in licence-production and service, and the Dassault-Breguet Mirage 2000 multirole fighter is on order to serve as primary air defense aircraft. The IAF has ordered a number of An-32s for transport that may be supplemented by Ilyushin 11-76 aircraft to meet the needs of heavy equipment transport. The IAF also has a force of 30 squadrons equipped with some ISO SA-2 Guideline and SA-3 GOA missiles.

A list of IAF flight equipment is presented on Table 5.3. Table 5.6 presents a list of military airports in India. These military airports could land civilian aircraft during emergency situations.

5.1.2.2 Indian Navy

The Indian Navy (IN) has 60 combat aircraft, including helicopters, and its air arm employs about 2000 personnel. The Navy is planning to boost its attack capabilities by acquiring BAe Sea Harrier aircraft. The current fixed-wing anti-submarine responsibility is assigned to one squadron with Dassault-Breguet Alize aircraft while the rotary wing ASW is undertaken by five squadrons equipped with Westland Sea King, Kamov Ka-25, and Aerospatiale Alouette III helicopters. Maritime reconnaissance is performed by two squadrons, one equipped with Ilyushin 11-38s and the other with L-1049 Super Constellations, which are being replaced with Ilyushin 11-38 aircraft. The liaison and search and rescue operations are performed by a squadron equipped with Alouette IIIs and three training and communication squadrons with a number of fixed- and rotary-wing aircraft. Limited transport and coast patrol capabilities are provided by five Norman Islanders aircraft. Table 24 presents the flight equipment of the Indian Navy.

5.1.3 Other Transportation Systems

Other transportation systems in India include the Indian Railway System and the Road Transportation System. The railways provide safe, comfortable, and fast passenger and freight transportation at a reasonable cost. The railways operate under Government control through the Railway Board and are self sufficient in the production of locomotives, coaches, wagons, signalling and telecommunication equipment. The railways handle nearly four billion passengers-miles and 270 million freights tons-miles of freight annually on a 38,000 mile network of railway tracks with 7,072 stations spread all over India (Figure 5.2). The track system is comprised of three interconnected gauge systems including broad gauge (5.5 ft.), meter gauge (3.25 ft.) and narrow gauge (2 ft. to 2.5 ft.)

During previous war emergencies, railways have been used for mass movement of heavy artillery, equipment and troops. Railways are expected to be used extensively in any future war emergency for personnel and equipment transfer because (a) they are the cheapest and fastest land transport system for bulk commodities and passengers, (b) they are comparatively energy efficient, (c) they are equipped with extensive communication networks, and (d) they are staffed with a skilled work force capable of adapting to emergency situations at short notice. One disadvantage of the use of railways is their non-uniform gauge system, which entails a reduction in speed. Also, the productivity of the railway maintenance units suffers from lack of sophisticated machinery, but these problems are slowly being rectified. Efforts are also being made to improve coordination between the railways and the airlines. All of these efforts will offer better facilities to the military during any future war emergency.

About 30 percent of the material shipped in India is transported by trucks. All vehicular traffic is generally curtailed during wars because of fuel shortages and due to blackouts at night. The military could acquire the use of private trucks under emergency regulations. However, the trucks lack performance reliability because the trucking companies operate with a high profit motive and little regard for essential maintenance of their equipment. Principal Roads of India are shown in Figure 5.3.

5.2 POTENTIAL USE OF CIVIL AIRLINES FOR MILITARY PURPOSES

During a war the military in India could draw support from Air India, Indian Airlines, and from airline subsidiaries if the military has exhausted its own transport resources or if the use of civilian aircraft offers some strategic or economic

advantage. Most likely the use of civil aircraft would be for the transportation of troops, VIP's, light equipment, arms, ammunition, and medical supplies; transfer of wounded soldiers from the battlefield; aerial reconnaissance of war-affected areas; and transfer of troops to perform peace keeping missions. The current Indian Air Force transportation capability include:

<u>Name</u>	<u>Characteristics</u>
An-12 Cub	Medium transport, crew of six and up to 100 paratroopers or 44,092 lbs. payload in the hold
An-32 Cline	Medium transport, crew of five and up to 39 troops (30 paratroopers) or 13,228 lbs. freight in the cabin
Boeing 727-200	Short and medium-range transport, crew of three and up to 189 troops or 40,000 lbs. freight in the cabin and hold
C-119G Packet	Medium-range transport, crew of three and up to 62 troops in the cabin
Douglas C47	Utility transport, crew of three and up to 32 troops or 4500 lbs. freight in the cabin
DHC-3 Otter	STOL utility transport, crew of one or two and up to 14 troops or 3,153 lbs freight in the cabin
DHC-4 Caribou	STOL tactical support, crew of two and up to 32 troops or 6000 lbs freight in the cabin

HS-748M

Short-range transport, crew of one or two and up to 55 troops and 14,000 lbs. freight in the cabin and hold.

The Boeing 727, which the Indian Air Force acquired from the civil airlines, offers the maximum troop or freight carrying capacity. Therefore, the Indian military has the option of increasing its air transport capability by using any or all of the civil aircraft shown on Table 5.5. The Indian Air Force is planning to increase its own transport capabilities by adding Russian built Ilyushin heavy transport aircraft (maximum capacity 140 troops or 88,183 lbs. freight), but until they are acquired, the present transport capabilities are limited to two 727s and several smaller transport aircraft. This limitation, depending upon the war situation, may impose a timing or troop strength disadvantage.

Any future military decision to use the civil aircraft during a war is expected to use the following selection criteria:

(a) the location of war front, (b) purpose of the flight, (c) length of runways at the airport, (d) support facilities, and (e) availability of fuel.

The following are some of the pros and cons of using civilian aircraft for military purposes:

- (a) Civil/Military Interface: In India, interface between the civil airlines and military is ongoing at many levels. Examples of the peacetime civil and military interface include: (1) hiring of discharged military personnel by the airline corporations; (2) the presence of high ranking military personnel as directors or top managers; (3) servicing of military aircraft at civil maintenance facilities; (4) the

joint use of selected airports by the civilian and military aircraft; (5) occasional training of military personnel at Indian Airlines training facilities; and (6) initial training of Indian civil aeronautical staff at military schools. All these activities provide significant contact between civil and military personnel and exposure to both operating environments and organizational structures. Under national emergency conditions, the military assumes a decision-making role but the internal organizational structure of the civil airlines and air services remains intact. The transition of civil airlines to military purposes in any future war is expected to be smooth because: (1) India has the experience of two wars in which the civil airlines were used for military purposes; (2) some civil and military interface goes on at all times in the areas of training, maintenance and communications; (3) the civil airlines employ ex-military personnel who have training in emergency procedures; and (4) the high ranking ex-military personnel in the management of the civil airlines are expected to facilitate communication for a smooth civil/military interface during war emergencies.

- (b) Readiness Posture: It could not be confirmed from public sources if the military and the civil airlines conduct joint exercises or drills to prepare the civilian staff for responding to war emergencies. At airport locations where there are few ex-military staff members, lack of training in emergency operations may increase initial response time during the early stages of a war.

- (c) **Personnel Experience:** About 40 percent of the pilots and cockpit staff, 35 percent of the ground operations staff and 20 percent of the maintenance staff working for the civil airlines have some military background. This training will be advantageous in integrating the civil airlines operations with the military operations during war emergencies. One area of weakness could be the lack of special training of ground support staff in handling, loading, and transporting military materials and equipment.
- (d) **Availability of Fuel:** The availability and storage capacity of fuel differs markedly between major, intermediate and small airports. If military situations demand the use of large civilian aircraft at smaller airports, the availability of fuel could be a limiting factor even if the runways are adequate.
- (e) **Weather considerations:** Depending on the timing of the military need to use the civil airlines and air services, weather could be a restraining factor; as during monsoon season, high winds and rains result in power outages and disruption of life in several major cities of India including Delhi, Bombay, Calcutta and in the southern part of India.

Other areas of civil operations, such as conversion of aircraft to carry troops and light equipment, maintenance capabilities, ground transportation, ground and air communications, age of fleet and availability of spare parts, are not considered to entail significant problems that could impact the civil airlines' abilities to serve the military's transportation needs during war emergencies. Overall, the Indian civil airlines appear to be fully capable of augmenting military transportation needs in future war emergencies.

TABLE 5.1 AIR INDIA FLEET

Type	Name of the Aircraft	Registration Marking	Delivery Date	Engine	Configuration and Crew Complement
<u>Boeing 747</u>					
1) 707-337C	Trishul	VT-DXT	22/8/1968	JT3D-3B7	
2) 747-237B	Shahjehan	VT-EBE	4/5/1971	JT90-7/7A/7Q	Standard Configuration
3) 747-237B	Rajendra Chola	VT-EBN	1/4/1972	JT90-7/7A/7Q	16 First Class (Slumberettes) 20 Club Class 358 Economy
4) 747-237B	Vikramaditya	VT-EBD	7/6/1972	JT90-7/7A/7Q	
5) 747-237B	Akbar	VT-EDU	27/12/1975	JT90-7/7A/7Q	Operating Crew
6) 747-237B	Chandragupta	VT-EFJ	6/2/1978	JT90-7/7A/7Q	Pilot, Co-pilot, Flight Engineer
7) 747-237B	Kanishka	VT-EFO	2/7/1978	JT90-7/7A/7Q	Cabin Crew
8) 747-237B	Krishna Deva Raya	VT-EFU	14/8/1979	JT90-7/7A/7Q	Infliight Supervisor, 17 cabin crew
9) 747-237B	Samudragupta	VT-EGA	23/12/1979	JT90-7/7A/7Q	
<u>Airbus A300-B4-200</u>					
10) 747-237B	Mahendra Verman	VT-EGB	22/2/1980	JT90-7/7A/7Q	
11) 747-237B	Harsha Vardhana	VT-EGC	4/4/1980	JT90-7/7A/7Q	Standard Configuration
12) A300-B4	Gange	VT-EHN	11/8/1982	CF6-50CZ	22 First Class, 216 Economy
13) A300-B4	Godavari	VT-EHO	12/8/1982	CF6-50CZ	Operating Crew
14) A300-B4	Cauvey	VT-EHQ	15/11/1982	CF6-50CZ	Pilot, Co-pilot, Flight Engineer
<u>Boeing 707</u>					
					Infliight Supervisor, 11 cabin crew
<u>Boeing 707</u>					
					Standard Configuration
					12 First Class, 152 Economy
					Operating Crew
					Pilot, Co-pilot, Navigator, Flight Engineer
					Cabin Crew
					7 cabin crew

TABLE 5.2 INDIAN AIRLINES FLEET

Type Aircraft	Average Seat First/Coach	No. of Aircraft	Engine
A300B2-100	0/278	8	CF6-50C
A300B4-200	31/242	2	CF6-50
B737-200	0/126	25	JT8D-9/17
F-27-100	0/52e	6	DART 514-7
F-27-400	0/52e	1	DART 532
F-27-600	0/52e	1	DART 532-7
HS-748	0/62e	12	DART 531

e = Estimated

TABLE 5.3 INDIAN AIR FORCE FLIGHT EQUIPMENT

Name and Number of Aircraft	Type	Made In	Quantity
<u>Attack, Bomber, Fighter, Interceptor, Reconnaissance Aircraft</u>			
Ajeet	Interceptor	India	89
Canberra (B1) 58/74/T.13/B(1).12	Bomber	UK	50
Gnat F.1	Interceptor	India	70
HF-24 Marut	Attack	India	90
HJT-16 Kiran MKI	Fighter	India	110
HJT-16 Kiran MKIA	Fighter	India	50
HJT-16 Kiran MKII	Fighter	India	20
Jaguar International	Fighter/Bomber	UK	16
MiG-21 FL/MF/BIS Fish Bed	Interceptor	USSR	450+
MiG-23 BN Flogger	Fighter/Bomber	USSR	70+
MiG-23 MF Flogger	Interceptor	USSR	40
MiG-25 R/U Foxbat	Reconnaissance	USSR	12/2
Mirage 2000	Interceptor	France	40
SU-7B Fitter-A	Fighter	USSR	75
<u>Transport Aircrafts</u>			
An-12 Cub		USSR	30
An-32 Cline (on order)		USSR	96
Boeing 737-200		USA	2
C-119G Packet		USA	38
C-47		USA	25
DHC-3 Otter		Canada	29

TABLE 5.3 INDIAN AIR FORCE FLIGHT EQUIPMENT (concluded)

Name and Number or Aircraft	Type	Made In	Quantity
<u>Transport Aircrafts</u> (Cont'd)			
DHC-4 Caribou		Canada	20
HS-748M		UK	42
<u>Trainer Aircrafts</u>			
HJT-16 Kiran		India	44
HPT-32		India	100+
HT-2		India	70
MiG-21T Mongol		USSR	40
MiG-23 UM Flogger		USSR	15
<u>Helicopters</u>			
Alouette Chetah		India	200
Mil MI-4		USSR	45
Mil MI-8 Hib		USSR	50
SA 316B Chetah		India	120

TABLE 5.4 INDIAN NAVY FLIGHT EQUIPMENT

Name and Number of Aircraft	Made In	Quantity
Breguet BR-1050 Alize	UK	20
Britten-Norman Islander	UK	11
Britten-Norman Defender	UK	5
de Havilland Devon	Canada	2
HJT-16 Kiran MK1A	India	15
Hughes-300	USA	4
Kamov Ka-25 Hormone A'	USSR	5
Ilyushin Il-38 May	USSR	3
L-1049 Super Constellation	USA	4
Sea Harrier FRS MK51	UK	6
Sea Harrier T.MK-4	UK	2
Sea Hawks	UK	25
Sea King MK 42/42/A	UK	14
Vampire T.MK55	UK	4
<u>Helicopters</u>		
SA316B Chetah (Alouette III)	France	18

TABLE 5.5. MILITARY TRANSPORT AND CIVILIAN AIRCRAFT OF INDIA

Name of Aircraft	Number of Aircraft	Passenger Capacity	Freight Capacity (lbs.)	Minimum Runway Requirements (ft.)	Range (miles)	Maximum Speed (mph)
<u>Military Transport Aircraft</u>						
Antonov An-12 Cub	30	100 Paratroops	or 44,092	-	2,237	482
Antonov An-32 Cline	96	39 Troops or 30 Paratroops	or 6,000	-	1,367	317
Boeing 737-200	2	130 Troops	+ 43,000	-	2,060	576
C-119G Packet	38	62 Troops	-	-	1,770	281
C-47	25	32 Troops	or 4,500	-	1,600	230
DHC-3 Otter	29	14 Troops	or 3,153	-	875	160
DHC-4 Caribou	20	32 Troop	or 6,000	-	242	216
HS-748M	42	55 Troops	+ 14,000	2,500	200	350
<u>Air India Aircraft</u>						
Boeing 707	1	144	14,000	8,000	5,300	535
Boeing 747	10	394	34,920	6,000	5,750-6,000	562
Airbus A300B4	3	331	20,216	5,445	3,400	582

TABLE 5.5. MILITARY TRANSPORT AND CIVILIAN AIRCRAFT OF INDIA (concluded)

Name of Aircraft	Number of Aircraft	Passenger Capacity	Freight Capacity (lbs.)	Minimum Runway Requirements (ft.)	Range (miles)	Maximum Speed (mph)
<u>Indian Airlines Aircraft</u>						
Airbus A300B2	8	331	70,547	5,445	3,400	582
Airbus A300B4	2	331	20,216	5,455	3,400	582
Boeing 737-200	25	130	43,000	6,000	2,060	576
Fokker F-27-100/400/600	8	48	14,193	2,310	1,160	302
HS-748	12	55	14,000	2,500	200	350

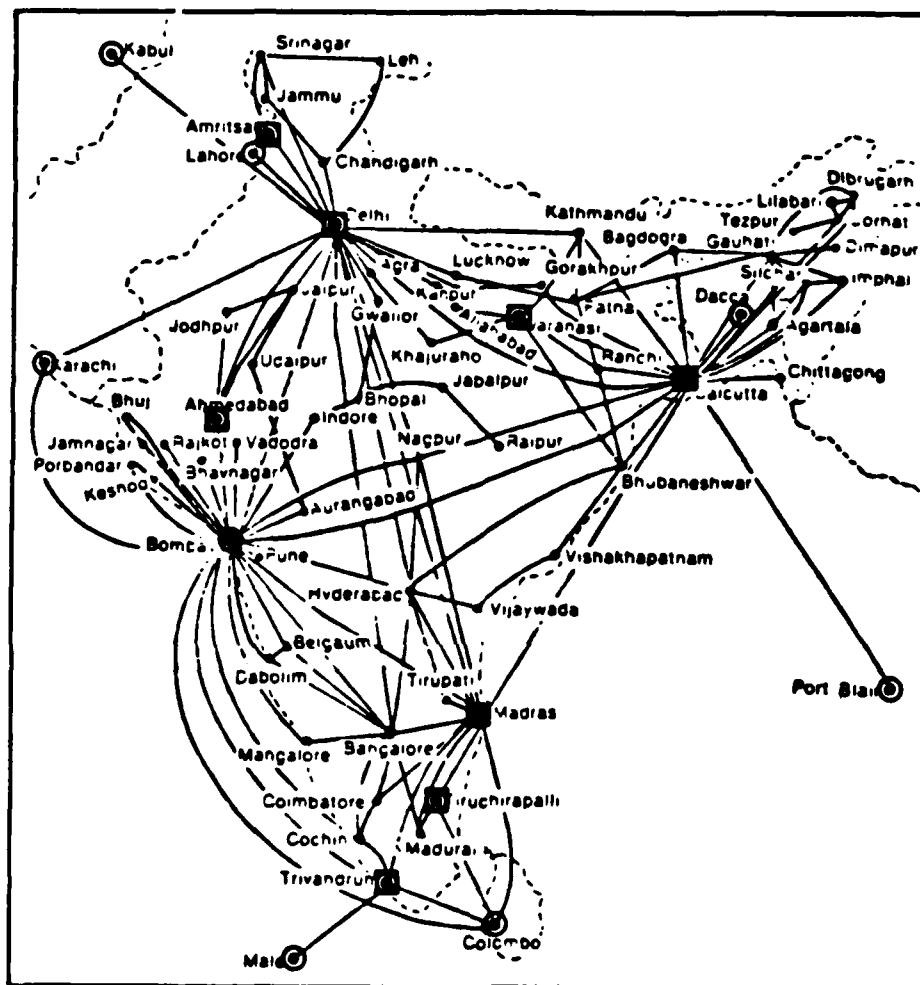
Table 5.6. MILITARY AIRPORTS OF INDIA

Airport	Geographic Coordinates				Runway Length/Type	Can Handle Civil Traffic
Agra	N27	09.0	E077	58.0	9000'/Concrete	✓
Baghddgra	N26	41.0	E088	20.0	9000'/Concrete	✓
Barrackpore	N22	39.2	E088	27.0	Not available	✓
Bangalore	N12	57.1	E077	40.0	10850'/Concrete	✓
Barielly	N28	35.0	E079	27.0	9000'/Concrete	✓
Begumpet	N17	27.2	E078	27.8	Not Available	
Car Nicobar	N09	09.0	E092	49.0	7500'/Concrete	✓
Chakulia	N22	27.9	E086	42.5	7283'/Concrete	✓
Chakeri (Kanpur)	N26	24.0	E080	25.0		
Chabua	N27	28.0	E095	07.0	9600'/Unpaved	Light A/C only
Chandigarh	N30	40.0	E076	47.0	9000'/Concrete	✓
Cochin	N09	57.0	E076	15.0	6000'/Asphalt	✓
Daboim (Goa)	N15	22.7	E073	49.7	7850'/Asphalt	✓
Dundigul (A.F. Academy)	N17	37.8	E078	24.3	8250'/Concrete	
Didar	N17	55.0	E077	30.0	Not Available	
Ferozpur	Not Available				Not Available	
Gilgit	Not Available				Not Available	
Gorakhpur	N26	44.0	E083	27.0	9000'/Concrete	✓
Gurgaon	Not Available				Not Available	
Gwalior	N26	17.0	E078	14.0	8970' Concrete	✓
Hakimpet	N17	27.2	E078	27.8	Not Available	
Halwara	Not Available				Not Available	
Hindon	Not Available				Not Available	
Jaipur	N26	49.4	E075	48.2	5955'/Tarmal	✓
Jammu	N32	42.0	E074	50.0	5556'/Steel Planking	No
Jormat	N26	44.0	E094	11.1	9000'/Concrete	
Jharsuguda	N21	54.9	E084	03.1	6175'/Concrete	Light A/C
Kacharapara	Not Available				Not Available	
Kakaikonda	Not Available				Not Available	
Kumbhigram	N24	54.7	E082	58.8	5857' Tarmal	✓
Leh	N34	08.0	E077	33.0	Not Available	
Manipur	N25	53.0	E093	46.0	5770'/Asphalt	✓
Muzaffarpur	N26	07.0	E085	18.9	3999'Bitumen	No
Ozar	N20	07.0	E073	55.0	9800'Unpaved	Light A/C
Prithigunn	N25	52.0	E082	01.0	6000'/Concrete	No
Pune	N18	35.0	E073	55.0	8800'/Concrete	✓
Ranchi	N23	18.8	E085	19.4	8900'/Concrete	✓
Safdarjung	N28	35.1	E077	12.5	3780'/Tarmal	Light A/C
Saharanpur	Not Available				Not Available	
Srinagar	N33	59.0	E074	47.0	12,000'/Concrete	✓

Table 5.6. MILITARY AIRPORTS OF INDIA (concluded)

Airport	Geographic Coordinates		Runway Length/Type	Can Handle Civil Traffic
Sulur	N11 01.0	E077 10.0	6457'/Concrete	✓
Tambaram	N12 54.0	E080 07.0	4764'/Concrete	✓
Tezpur	N26 43.0	E092 47.0	Not Available	
Udampur	N32 65.0	E075 09.0	9010'/Asphalt/ Concrete	✓
Yellahanka	N13 08.0	E077 37.0	7217'Concrete	✓

All civilian airports in Category I, II and III can also support military aircraft.



- ⊙ Foreign airports served by Indian Airlines
- Indian civilian airports
- ◻ For airport description, refer to INDIA Vol. III of the report.

Figure 5.1. CIVILIAN AIRPORTS OF INDIA

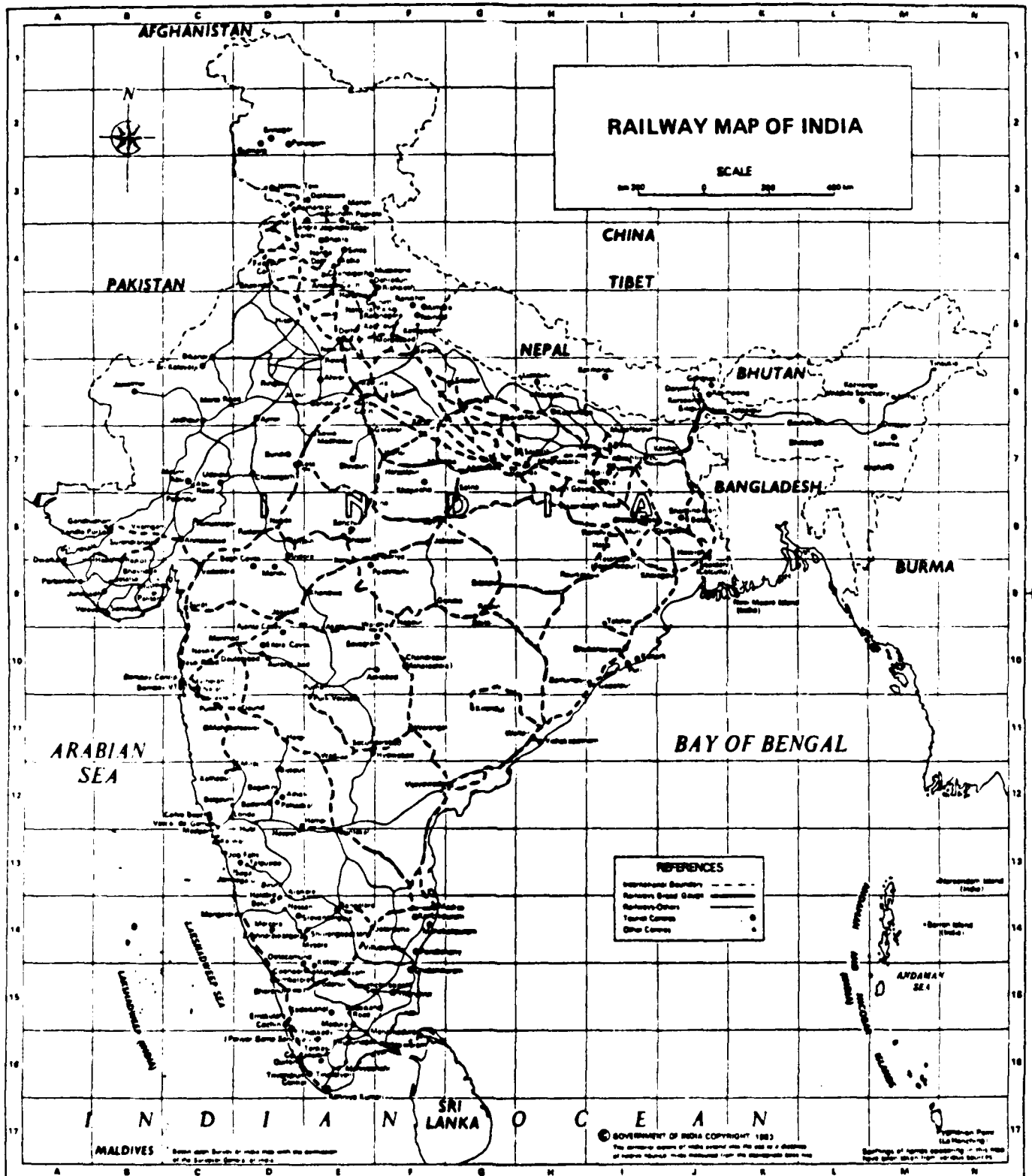


Figure 5.2. PRINCIPAL RAILWAYS OF INDIA

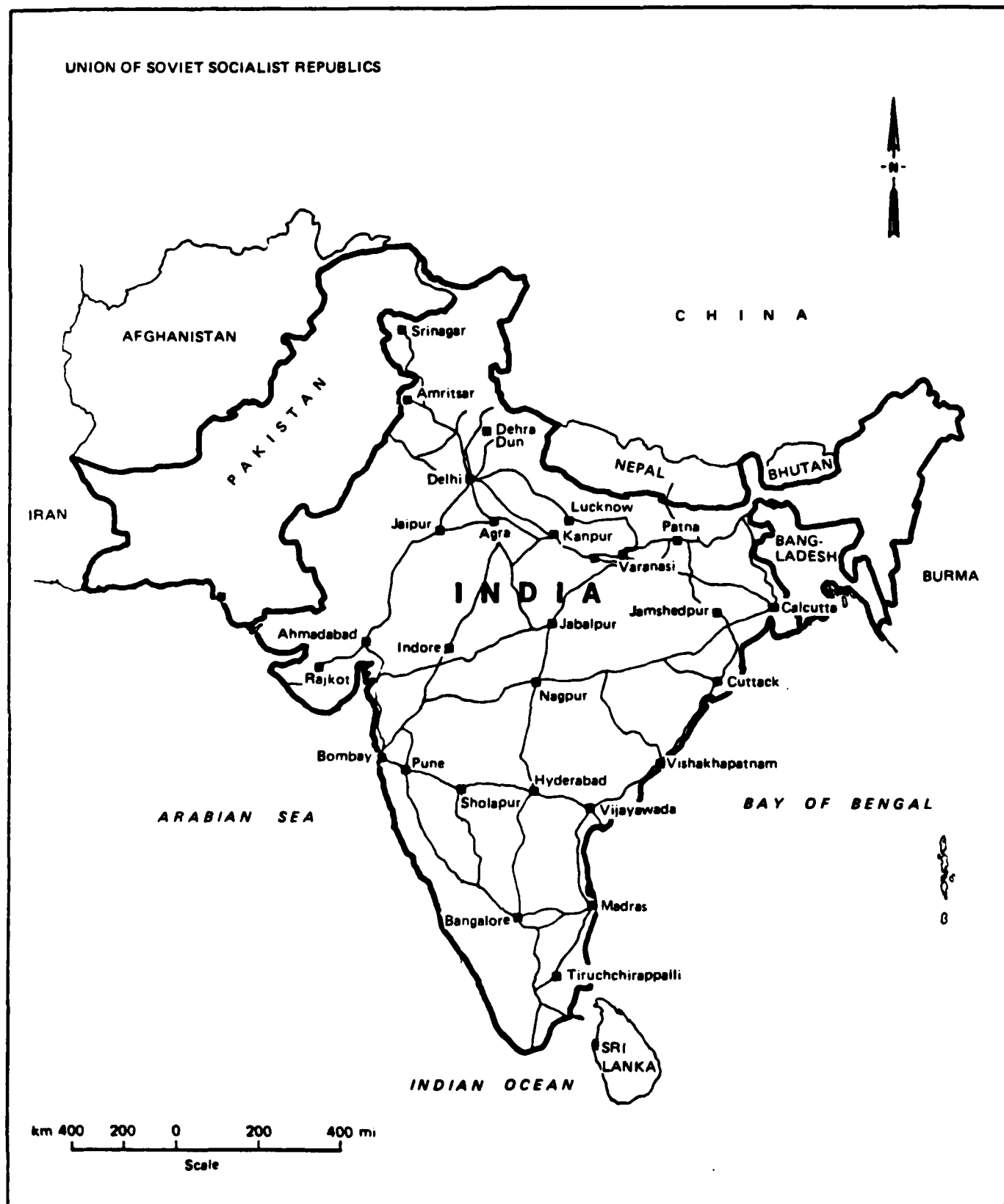


Figure 5.3. PRINCIPAL ROADS OF INDIA

6.0 PAKISTAN AIR SERVICES

6.1 OVERVIEW, CAPACITY AND CAPABILITY

6.1.1 Civil Airlines/Air Services

6.1.1.1 Pakistan International Airlines (PIA)

Pakistan International Airlines (PIA) is the only commercial air carrier of Pakistan. PIA operates a fleet of 30 aircraft including 21 jets and nine turboprops. These aircraft include six Airbuses, seven Boeing 707s, four Boeing 747s, nine Fokker 27s and four DC-10s. Four airbuses are about four years old; the other two were purchased in 1983. Most of the Boeings were acquired in mid-seventies; the Fokkers in sixties and seventies. The DC-10s are about eight years old. At least fifty percent of the PIA fleet is ten years or older. Details of PIA aircraft are presented on Table 6.1.

PIA has three maintenance bases located at Karachi, Lahore and Rawalpindi that employ about 5,000 maintenance-related staff. To a large extent, PIA is self sufficient in fleet servicing and operations. PIA offers complete servicing of jet aero-engines and Boeing 707, 720 and 747 aircraft; repair and overhaul of avionics equipment; repair of pneumatic components fitted on Fokkers, Boeings and DC-10s; and repair and maintenance of DC-10s and Airbuses. PIA has an automated inventory control system and computer facilities at its major maintenance base at Karachi. Since PIA has the necessary equipment and trained personnel to carry out major overhaul and maintenance functions in-house, PIA's aircrafts are properly maintained, thus increasing their operational effectivity and reliability during emergency situations. The PIA maintenance bases are also equipped to change seat configuration or perform

necessary modifications to convert a commercial aircraft into a military transport aircraft within the confines of the original aircraft structure and specifications.

The communication facilities available in Pakistan include telephone, teleprinter, radio communication mobile units, wireless communications, microwave networks, aeronautical telecommunication networks and courier service. There is direct dial service within Pakistan to various major cities and all airports are equipped with telephone, teleprinter or wireless communication. The quality of service is fair to good. In-flight communication is provided by the standard communication package on board various aircraft.

PIA is financially sound and ten-year operating statistics show that its operation has always been profitable in spite of a glut in domestic and foreign travel during the last several years. PIA does not seem to have difficulty in raising loan capital to buy new aircrafts. The airline is presently undergoing a fleet replacement and expansion program which is expected to increase its fuel and operational efficiency.

Although PIA is an autonomous corporation, it legally operates under direct Government control. The use of civilian aircraft for military purposes during any war emergency does not seem to be a problem.

6.1.1.2 Airports

There are 102 usable airfields in Pakistan including military and civil aviation airports. About 66 airfields in Pakistan have a permanent surface; 26 airfields offer a runway of 8000 feet or more. The airport located at Quetta has a 12,000 foot runway. The locations of major civil, military and proposed

airports are listed on Table 6.6. Figure 6.1 shows the location of Pakistan Civil and Military airports on the map. The equipment and facilities differ markedly between major and minor airports. The maximum passenger and cargo handling capabilities are at Karachi, Lahore, Islamabad and at Peshawar airports. The facilities available at smaller airports are sufficient to handle their normal traffic volume but the increase load during emergencies may impose a problem, depending on the need and duration. About 75 percent of the airports in Pakistan are smaller airports. About 80 percent of the civil airports offer ground navigation aids including approach lights, end identifiers, HIRL, VASI, VOR, ILS/Radar and ATC Towers in various combinations. While major airports have most of these navigation aids, smaller airports have only one or two; an emergency this could be a limiting factor if the airport is used extensively for military purposes, particularly during night hours.

6.1.1.3 Personnel

PIA employs a total of 20,000 personnel which comprised of 3.5 percent pilots and cockpit personnel, 27.5 percent maintenance staff, and 69 percent support personnel. At the present time, a great majority of the technical staff are direct recruits who had technical diplomas or degrees before joining the PIA. After being recruited, these personnel were trained at PIA training centers and passed examinations conducted by the Civil Aviation Authority in their technical specialities before they assumed their operational duties with the PIA. The PIA aeronautical staff, as a part of their training, also attend the Pakistan Air Force School. The training process emphasizes technical performance and the handling of operational emergencies caused by malfunction or breakdown of the equipment. It could not be confirmed from public information

sources if specific training is provided to handle war emergencies but the PIA staff appears to be capable of handling operational emergencies that might occur in war. A large percentage of directors and top management of PIA are retired or active military personnel who are expected to facilitate civil/military communication and combined operations during war emergencies.

6.1.1.4 Other Civilian Aircraft

Other civilian aircraft are owned and operated either by the Government of Pakistan or by various flying clubs in the country. Generally these are small single engine aircraft that could accommodate two to eight passengers. Their military utility is very limited. Table 6.2 presents an inventory of other civilian aircraft of Pakistan.

6.1.2 Military Aircraft

6.1.2.1 Pakistan Air Force

Pakistan Air Force (PAF) has about 220 combat aircraft and 17,600 personnel. The PAF's main offensive capability rests with its squadron stationed at Masroor Air Base (Karachi), which is equipped with Martin B-57B bombers. Based at Sargodha Air Base are four squadrons equipped with Dassault-Breguet Mirage aircraft which could perform interception, fighter bomber, and tactical reconnaissance roles. In addition to these squadrons, the PAF has eight other squadrons that operate J-6 aircraft from bases at Sargodha, Masroor, Mianwali, Rafiqui and Peshawar. These squadrons perform fighter/ground attack roles. The aircraft in these squadrons have been modified to carry two AIM-9 sidewinder air-to-air missiles for improved interception capability. The striking capabilities of these

squadrons may be supplemented by Chinese A-5 Phantom strike aircraft that the PAF has on order. The PAF's transport support aircraft are based at Chaklala (Rawalpindi) and Masroor (Karachi) Air Bases which operate Lockheed Hercules (10C-130B, C-130E, L-100-20) aircraft. The PAF operates a number of fixed and rotary-wing aircraft in liaison and search-and-rescue roles.

The flying school at Risalpur provides initial flight training on PAC Mushaq and Cessna T-37B aircraft and further training on Lockheed T33A and Shenyang FT-6s aircraft which are based at Mianwali Air Base.

Table 6.3 provides a list of Pakistan Air Force aircraft.

6.1.2.2 Pakistan Navy

The Pakistan Navy has a small contingent of aircraft based at Karachi. These aircraft include three Breguet Atlantics, six Westland Sea King MK45 helicopters and four Aerospatiale Alouette III helicopters. Table 6.4 includes a list of Pakistan Navy aircraft.

6.1.2.3 Pakistan Army

Table 6.4 presents a list of aircraft operated by the Pakistan Army. These aircraft include 50 Cessna O-1E Bird Dogs for observation and forward air control, 24 Mushags, and 24 Rheins FTB-337s. The army's combat and transport helicopters include 35 Aerospatiale SA 330 Pumas, 12 Mil Mi-8s, 20 Aerospatiale Alouette III and one Bell 47G. It is also reported that the army has 12 Bell AH-1S Cobra antitank helicopters. The army does not have any transport aircraft.

6.1.3 Other Transportation Systems

Other modes of mechanized transportation in Pakistan include Pakistan Railways and Road Transportation System. The railways are owned and operated by the Government of Pakistan, and have extensive facilities for manufacturing and assembling locomotives, coaches, wagons, and signalling and telecommunication equipment. The railways have a network of about 5,400 miles of track with about 840 stations spread throughout the country except in the extreme northern and western parts of Pakistan, which are accessible by air or road only. The railways' annual passenger and freight volume is around six billion passenger-miles and five billion ton-miles respectively. During the last two Pakistan wars with India in 1965 and 1971, railways were extensively used for mass military movements. Since 1965 major improvements have been made in the overall track network and in the scheduling system. The railways offer an efficient and comparatively cheap mode of transportation for heavy equipment and military personnel transport during war emergencies. The system has been tested in previous wars with varying success, and it is expected to be used again during any future war emergency. Figure 6.2 presents Pakistan Railways' network.

Pakistan has an elaborate and expanding road system that is catching up with the railway as a principal means of moving goods and people (Figure 6.3). There are estimated to be over 50,000 miles of roads; 40 to 50 percent are paved. There are several major highways which have been built recently. The condition of the roads is fair in Pakistan and the Government is spending considerable amounts of money to improve general conditions of the road system on a sustained basis, but visible progress is slow. According to one estimate, there are about 50,000 trucks, 25,000 buses and 150,000 private cars using the

road system in Pakistan. During the 1965 and 1971 wars with India, trucks and buses were impounded to save gasoline and were used in a limited way for military purposes. In case of an emergency in Baluchistan or in the extreme northern areas of Pakistan, the road system will offer a viable means of transport for the military. Private buses and trucks may not be useful for long hauls, however, as they are not properly maintained and may breakdown at remote places with limited or no repair facilities.

6.2 POTENTIAL USE OF CIVIL AIRLINES FOR MILITARY PURPOSES

The Pakistan military could call upon civil aviation resources to assist during natural disasters, major internal disturbances, wars or military peace keeping missions. It is anticipated that civil aviation will be used for mass troop and light equipment movement, reconnaissance of disturbed areas within Pakistan, transportation of arms and ammunition, transfer of wounded from the battlefield, and carrying military peace keeping missions within and outside the country. Table 6.5 shows a comparison of transport capabilities of the PAF aircraft, and the PIA fleet.

During war emergencies, the civilian aircraft will increase the military's transport capabilities. At the present time, the military has the following transport aircraft:

<u>Type</u>	<u>Description</u>
Hercules C-130 B/E	Medium combat transport, crew of five, up to 92 troops (64 paratroops) or 43,400 lbs of freight in the hold

<u>Type</u>	<u>Description</u>
Fokker F-27-200	Medium transport, crew of four, up to 48 troops or 24,000 lbs. in the cabin and hold
L-100-201	Medium combat transport, crew of five, up to 92 troops (64 paratroops) or 43,400 lbs of freight in the cabin and hold

It is obvious that the Pakistan Air Force has somewhat limited capabilities for a speedy mass troop movement. If such a need arises in the future, civilian aircraft of PIA can supplement this capability. Before PIA is commandeered, it is expected that the military would first evaluate its own resources and other modes of transportation and use PIA aircrafts only if it offered a strategic or economic advantage. If it is established that civilian aircraft are needed for military purposes, the decision to use a particular type of civilian aircraft will depend on the location of war front, length of runways at the airports, support facilities, availability of fuel and the purpose of flight. The following are some of the strengths and weaknesses of using civilian aircraft for military purposes:

- (a) Civil/Military Interface: The Civil Aviation Department and PIA work under the Ministry of Defense; therefore civil/military interface is an on-going process. This includes: (1) joint search and rescue operations, (2) sharing of meteorological information, (3) initial training of civil aeronautical staff at Air Force schools, (4) cross training of military Air Traffic Controllers, (5) occasional maintenance of Air Force aircraft at PIA

maintenance facilities, (h) hiring of ex-military personnel by civil airlines, and (7) the appointment of active senior military personnel to head Civil Aviation and the PIA. During war emergencies, the civil airlines operate directly under military command; the military assumes a decision-making role but keeps the administrative structure intact. All major operations are performed under military supervision and military activities take precedence over all other functions. PIA, because of its interface with the military during normal peacetime conditions, provides a relatively smooth transition to serve the needs of the military during emergency conditions. One weakness may be the readiness posture of lower staff which, after long working in a civil peacetime environment, may lack the discipline and training for a timely action, particularly during the initial stages of war.

- (b) Availability of Fuel: All grades of fuel are not available at all civilian airports. Although military airports are located throughout the country, the non-availability of a specific grade fuel could limit the use of a civilian airport for military purposes during a war.
- (c) Use of Civilian Airports: Most of the airports in Pakistan are located away from cities and population centers but a few large cities such as Karachi, Lahore and Rawalpindi have grown towards the airports. Except at major airports, functions such as security arrangements, cargo handling and maintenance capabilities may be limited. In war emergencies, these factors may restrict the use of many airports for military purposes.
- (d) Other areas of civil operations such as convertibility of aircraft for military transport of men and light equipment,

communications, condition of civilian fleet, maintenance capabilities, ground transportation, and availability of spare parts are not considered to be problem areas that would hinder the capabilities of civil airlines to assist the military during war emergencies. Overall, the Pakistan civil airlines appear to be capable of augmenting the military strength by supplementing its troop and light equipment carrying capability during war emergencies.

TABLE 6.1 PAKISTAN INTERNATIONAL AIRLINES FLEET

<u>Type</u>	<u>Serial No.</u>	<u>Date of Manufacture</u>	<u>Date of Delivery To This Operator</u>
AB A300B4-203	96	11/79	3/80
	98	1/80	3/80
	99	2/80	4/80
	114	6/80	8/80
	314	4/83	4/83
	315	7/83	7/83
Boeing B707-373C -340C	18991	10/65	6/71
	19866	8/68	8/68
	19286	9/67	9/67
	20488	12/70	12/70
	19636	7/68	5/77
	19635	5/68	7/77
	19576	6/68	1/82
B747-282B -230B Combi -240B Combi	20928	6/74	4/76
	21035	10/75	4/76
	21825	7/79	7/79
	22077	3/80	3/80
Fokker F27-200 -400	10164	12/60	1/61
	10187	10/61	10/61
	10278	6/65	7/65
	10307	9/66	9/66
	10288	11/65	4/73
	10243	1/64	1/79
	10230	7/63	6/79
	10207	7/62	8/81
	10355	2/68	3/68
MDD DC-10-30	46931	3/74	3/74
	46940	4/74	4/74
	47889	8/76	8/76
	47868	5/75	5/83

TABLE 6.2 PAKISTAN GOVERNMENT AND FLYING CLUBS FLEET

Type	Serial No.	Date of Manufacture	Date of Delivery To This Operator
<u>Pakistan Government Fleet</u>			
<u>Karachi</u>			
(6) DHC-2 Beavers		(Unknown)	
(8) Cessna A185F			
(10) Fletcher			
Fu-24-950			
<u>Lahore</u>			
(2) Cessna A185F			
(2) Fletcher			
Fu-24-950			
<u>Flying Clubs Fleet</u>			
<u>Karachi</u>			
(2) Cessna A185F		(Unknown)	
(2) 150			
(1) 206			
(1) 310			
(1) Piper Cherokee			
140 (PA-28)			
<u>Lahore</u>			
(2) Cessna 185			
(1) 150			
(1) 172			
(1) 182			
<u>Multan</u>			
(2) Cessna 172			
(1) 150			
(1) 180			
<u>Rawalpindi</u>			
(2) Cessna 150			
(1) 180			
(1) Piper Super Cub			
150 (PA-18)			

TABLE 6.3 PAKISTAN AIR FORCE FLIGHT EQUIPMENT

Name and Number of Aircraft	Type	Made In	Quantity
<u>Attack, Bomber, Fighter, Interceptor, Reconnaissance Aircraft</u>			
A-5 Phantom	Fighter/Bomber	USA	(42) Ordered
B-57B Canberra	Bomber	UK	11
F-6 Farmer	Fighter/Bomber	China	120
F-16 A/B	Interceptor/Attack	USA	34/6
FT-5 (MiG-17U)	Fighter	China	15
FT-6	Fighter	China	10
Mirage 111EP/111RP	Interceptor	France	17/13
Mirage 111DP	Reconnaissance/ Trainer	France	3
Mirage 5PA	Fighter/Bomber	France	28
Mirage 5 PA2	Fighter/Bomber	France	30
<u>Transport Aircraft</u>			
C-130B/E Hercules		USA	12
F27-200 Friendship		USA	2
L-100-20		USA	1
<u>Trainer Aircraft</u>			
Cessna 172N		USA	4
Cessna T37B		USA	40
FT5/FT-6		China	20/16
MF1-17B Mushaq		Sweden	60
Mirage 5DP		France	2

TABLE 6.3 PAKISTAN AIR FORCE FLIGHT EQUIPMENT (Continued)

Type	Serial No.	Date of Manufacture	Date of Delivery To This Operator
<u>Trainer Aircraft (continued)</u>			
Mirage DPA2		France	2
T33A/RT-33A		USA	10/+5
T-37B		USA	40
<u>Other Aircraft</u>			
Beach Baron/Travel Air		Liaison	1/1 ordered
Falcon 20	VIP	France	1
HH-43B Huskee	SAR	USA	4
SA-330J Puma	VIP	France	1
Seneca II	Liaison		2
<u>Helicopters</u>			
Alouette III		France	14
Bell 47G		USA	12

TABLE 6.4 PAKISTAN ARMY AND NAVY FLIGHT EQUIPMENT

Name and Number of Aircraft	Made In	Quantity
PAKISTAN ARMY AIRCRAFT		
AH-1S Cobra	USA	12
Cessna O-1E Bird Dog	USA	50
Saab (PAC) Mushaq	Sweden	24
Rhein FTB 337	W. Germany	24
<u>Helicopters</u>		
Bell 47G	USA	20
Mi-8 Hip	USSR	12
SA316B Aloutte III	France	20
SA330 Puma	France	35
PAKISTAN NAVY AIRCRAFT		
Breguet Br 1150/Atlantic MK1	France	3
<u>Helicopters</u>		
SA319B Aloutte III Astazon	France	4
Westland Sea King MK45	France	6

TABLE 6.5 MILITARY TRANSPORT AND CIVILIAN AIRCRAFT OF PAKISTAN

Name of Aircraft	Number of Aircraft	Passenger Capacity	Freight Capacity (lbs.)	Minimum Runway Requirements (ft.)	Range (miles)	Maximum Speed (mph)
<u>Military Transport Aircraft</u>						
C-130 BE Hercules	12	92 troops or 64 paratroops	43,400	--	2487	375
Fokker F27-200	2	48 troops or 46 paratroops	14,193	2310	1197	302
L-100-20	1	92 troops or 64 paratroops	43,400	--	2483	375
<u>Pakistan International Airlines Aircraft</u>						
Airbus A300B4	6	336	70,547	5445	2900	528
Boeing 707	7	189	96,000	8000	4235-6160	535
Boeing 747	4	B-480 B-Combi-226	140,000 160,000	6000	5200	562
Fokker F27-200	9	48	14,193	2310	1197	302
MDD DC-16-30	4	380	106,550	5350	4000	--

TABLE 6.6 CIVILIAN AND MILITARY AIRPORTS OF PAKISTAN

Name/Code and Location of Airport	Geographical Coordinates	Runway Dimensions (ft)	Pavement Type
<u>Civilian Airports</u>			
Kundian, Chasma	N3225.4/E07127.4	3,500x80	Asphalt
Chilas, Chilas	N3225.7/E07405.0	4,500x100	Asphalt
CJL, Chitral	N3553.2/E07147.7	5,800x100	Asphalt
DSK, D.I. Khan	N3154.6/E07053.8	5,000x75	Asphalt
Faisalabad, Lyallpur	N3122.2/E07259.9	9,100x100	Concrete
		9,300x100	Asphalt
GIL, Gilgit	N3555.2/E07420.2	5,400x100	Asphalt
HDD, Hyderabad	N2519.3/E06821.8	7,000x100	Asphalt
Chakla, Islamabad	N3336.8/E07306.3	8,450x150	Concrete
		9,000x150	Concrete
Jacobabad, Jacobabad	N2816.8/E06827.1	10,000x150	Asphalt
JIW, Jiwani	N2507.7/E06148.5	5,413x164	Gravel
OKT, Kohat	N3334.4/E07126.4	8,071x150	Concrete
LHE, Lahore	N3131.8/E07424.2	9,000x150	Concrete/
			Asphalt
Mangla, Mangla	N3303.0/E07338.3	5,000x100	Asphalt
Mianwali, Mianwali	N3233.0/E07133.0	10,000x150	Concrete
MJD, Moenjodaro	N2720.2/E06808.5	6,500x100	Asphalt
Mux, Multan	N3012.2/E07125.1	9,000x150	Asphalt
WNS, Nawabshah	N2613.2/E06823.5	9,000x150	Concrete
PJG, Punjgur	N2657.0/E06408.4	5,000x150	Gravel
PSI, Pasni	N2517.0/E06323.0	9,000x100	Concrete/
			Bitumen
PEW, Peshawar	N3359.7/E07131.0	9,000x150	Asphalt
Quetta	N3015.2/E06656.3	6,540x150	Asphalt
Samungli		12,000x150	Asphalt
RYK, Rahim Yar Khan	N2825.0/E07018.0	4,500x100	Brick
SDT, Saidu Sharif	N3448.8/E07221.2	6,270x160	Asphalt
KDU, Skardu	N3520.0/E07532.1	6,600x110	Asphalt
SUL, Sui	N2838.0/E06910.0	5,000x100	Soil

TABLE 6.6 CIVILIAN AND MILITARY AIRPORTS OF PAKISTAN (Continued)

Name/Code and Location of Airport	Geographical Coordinates	Runway Dimensions (ft)	Pavement Type
SKZ, Sukkur	N2743.4/E06847.4	9,000x100	Asphalt
Sargodha, Sargodha	N3359.5/E07236.5	5,600x100	Asphalt
Turbela, Turbela Jam	N3203.0/E07240.0	9,000x150	Asphalt
Turbat, Turbat	N2559.0/E06301.9	6,000x100	Asphalt
Wana, Wana	N3218.3/E06934.3	4,900x160	Concrete
<u>Military Airports</u>			
Chandhar (AFB) Chandhar	N3205.8/E07347.7	9,000x120	Asphalt
Jacobabad (Military) Jacobabad	N2186.8/E06827.1	10,000x150	Asphalt
Masroor (AFB) Karachi	N2454.0/E06657.0	9,000x200	Asphalt
		9,000x115	Concrete
Walton (Air Force/Army Station) Lahore	N3130.0/E07420.0	6,230x150	Concrete
Mianwali (AFB) Mianwali	N3233.8/E07134.4	10,150x100	Asphalt/ Concrete
Murid (AFB) Murid	N3254.7/E07246.5	8,858x98	Asphalt
Dhamil (Army Base) Qasim	N3333.7/E07301.9	3,300x150	Asphalt
		6,690x150	Asphalt
Shorkot Road (AFB) Rafiqui	N3045.8/E07117.0	10,000x160	Asphalt
Sargodha (AFB) Sargodha	N3203.0/E07240.0	7,940x140	Asphalt
		10,050x150	Asphalt
<u>Proposed Civil Airports</u>			
Bahawalpur			
Kohat			
Okara			
Ormara			

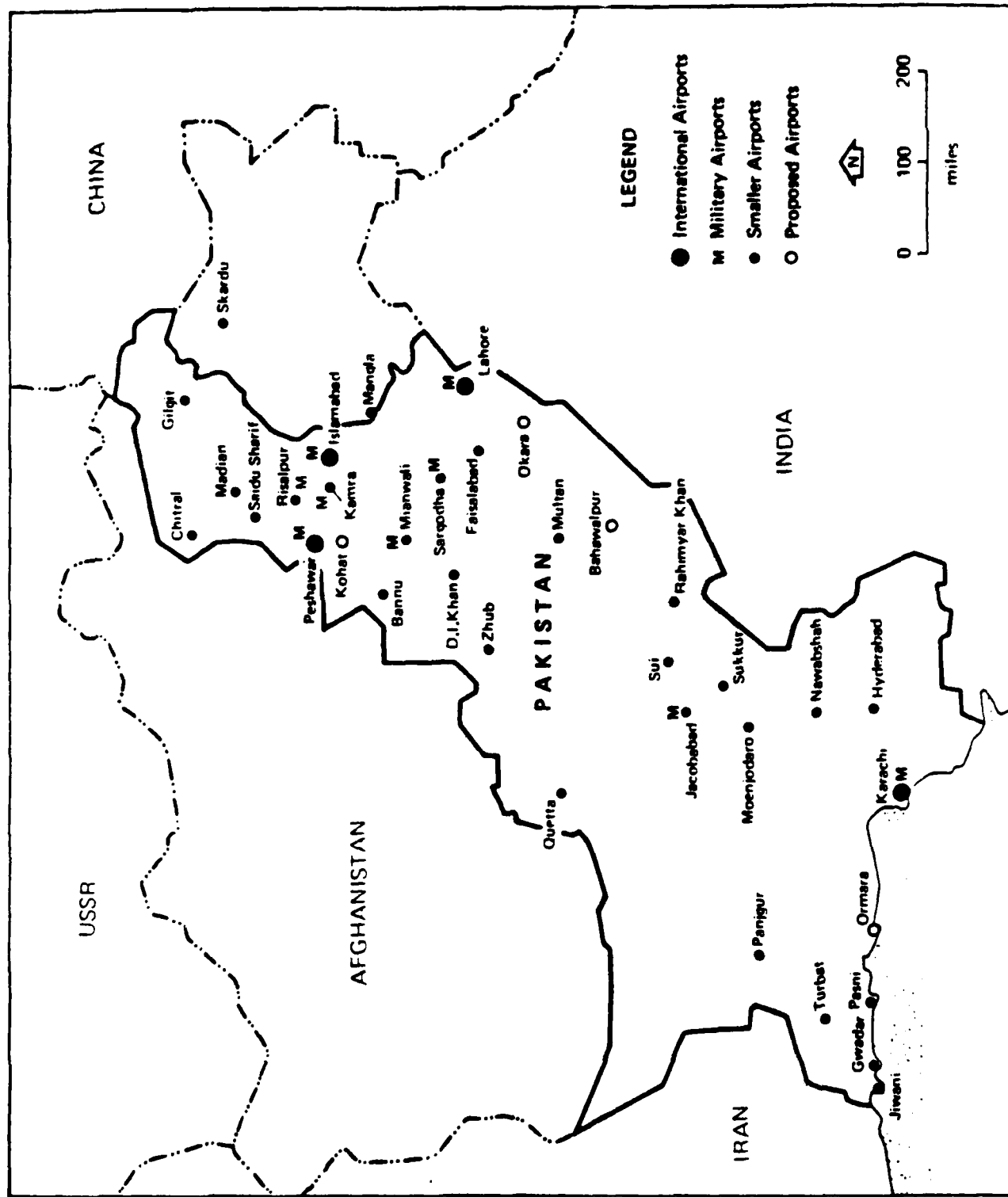


Figure 6.1. PAKISTAN CIVIL AND MILITARY AIRPORTS

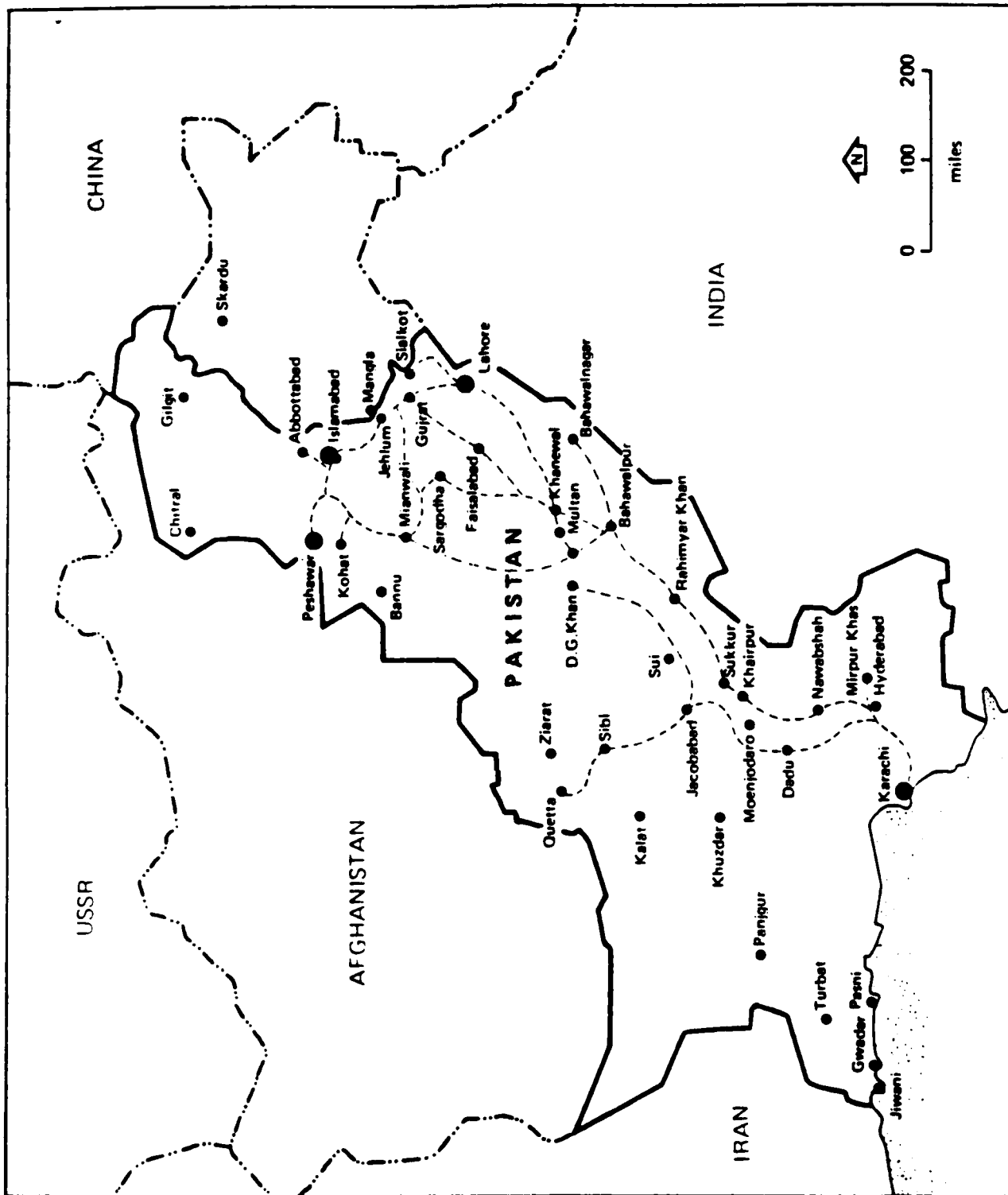


Figure 6.2. PAKISTAN RAILWAY SYSTEM

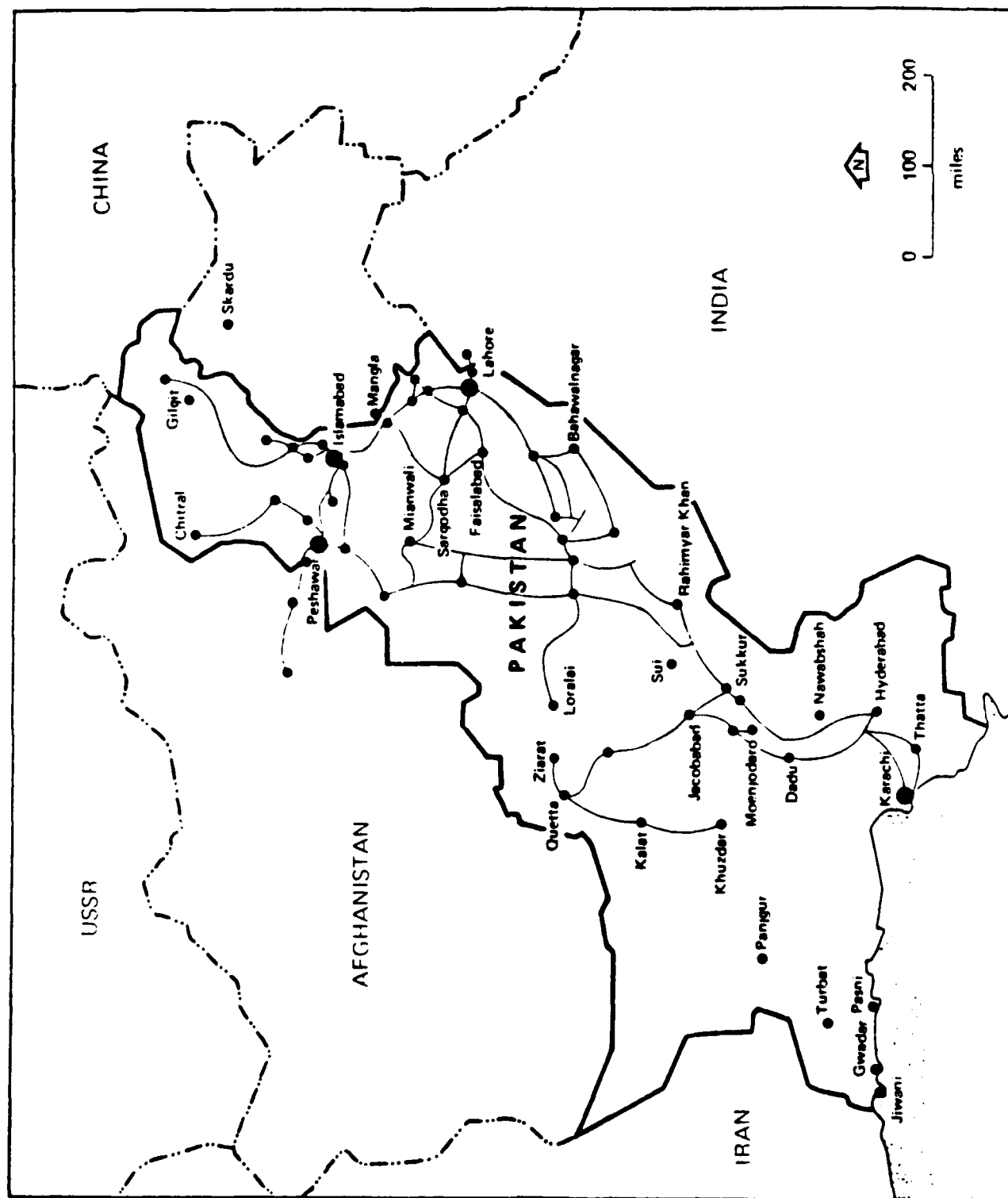


Figure 6.3 PAKISTAN MAJOR HIGHWAY SYSTEM

**Civil Airlines/Air Services in Bangladesh
India and Pakistan**

Prepared for
**Defense Intelligence Agency
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CIVIL AIRLINES/AIR SERVICES
IN BANGLADESH, INDIA AND PAKISTAN

Volume II - Bangladesh
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1.0 SUMMARY

As part of an inventory and evaluation of the civil airlines/air services in Bangladesh, India, and Pakistan, data on the civil airlines of Bangladesh have been collected and presented as Volume II of this study. The primary objective of this study was to evaluate the role that civil aviation could play in supporting the Bangladesh military forces if called upon during war and other national emergencies.

The project team has developed a research methodology and collected data on the number and condition of the civil air carrier Bangladesh Biman Airlines fleet, aircraft fleets operated by the Bangladesh Government and Dacca Flying Club, and military aircraft. Data has also been collected on the civilian and military airports, airline personnel, communication systems, maintenance facilities, and the future outlook of the airline and other transportation systems. Only publicly available information is used in the study.

The research indicates that the civil aviation resources of the country are still in a formative stage and the country lacks sufficient financial resources to modernize its fleet. Progress in civil aviation is slow because of dependancy on foreign loans; fleet expansion decisions are tied in with the borrowing capabilities of the Bangladesh government. Maintenance and availability of spare parts for the aging Bangladesh Biman fleet appear to be problems. Except at Dacca and Chittagong airports, Bangladesh has very limited night landing and fuel facilities. The majority of the airports could land only small aircraft.

Since its formation in 1971, Bangladesh has not been involved in any war. Therefore, the evaluation of civil and military interface during a possible war emergency is based on the personal experience of the project team in similar situations in the Indo-Pakistan subcontinent and a knowledge of the operating framework

of Bangladesh Biman. Within the operating limitations of the airline, which include daytime operations, limited fuel availabilities, weather conditions, serviceability of the airports, length of the runways and response time of the civilian crew to meet military emergency demands, the Bangladesh Biman, in a limited way, could supplement the military's mass and speedy troop and light equipment movement capabilities.

The research team briefly touched on other major transport systems of Bangladesh, including transportation by water and by land. Water transport is a major source of movement of goods and people in Bangladesh; geographically and economically it offers a viable alternative to the military for mass troop and equipment movement. Bangladesh Railway covers nearly two thirds of the country and offers many times more carrying capacity to the military than the civil airlines. In any future war situation, it is expected that these two modes of transportation will play a significant role in the military's troop and equipment carrying capacity.

Overall, the present civilian aviation resources of Bangladesh appear to be capable of augmenting military needs in a limited way during war emergencies.

2.0 INTRODUCTION

Woodward-Clyde Consultants (WCC), under contract No. MDA 908-84-C-0834 with the Defense Intelligence Agency (DIA), has performed a study entitled Civil Airlines/Air Services in Bangladesh, India and Pakistan. The purpose of the study was to examine and evaluate (1) capability and capacity of the civil airlines and civil air services of the three countries, (2) their potential to support their country's military forces in the event of conflicts or other national or defense emergencies, and (3) past use of civil airlines/air services in these countries during such occurrences.

The objectives of the study as outlined in the contract statement of work and as discussed with the DIA in a meeting on March 29, 1984 at Washington D.C. include:

- o Inventory of civil airlines' flight equipment and their capacity for normal operations
- o Description of civilian airports, personnel, communication systems, and maintenance facilities
- o Organizational, legal, and operational framework of each country's airline, its financial resources and future outlook
- o Previous history of the use of civil airlines and other transportation systems during national emergencies
- o Civil airline and military interface during normal and emergency conditions
- o Review of the capabilities of military aircraft and military airports
- o Evaluation of the capabilities and potential of the civil airlines to serve the needs of the military if called upon during national emergencies.

This report is divided into four volumes. Volume I is a summary report which provides an overview of the capacity and capabilities of each country's civil and military airlines, including flight equipment, airport data, personnel information, level of training, maintenance capabilities, future planned acquisitions, and a brief description of each country's military aircraft and military airports. Based on available data, the potential use of the civil airlines is evaluated and their operating environments are reviewed to determine the civil airlines' capabilities to

serve the needs of the military during emergencies. Bangladesh, India, and Pakistan are discussed individually and in more detail in Volumes II, III, and IV, respectively. These volumes present available factual data including an inventory of aircraft, list of airports, staff categories and their training requirements, communication systems, maintenance facilities, and a brief assessment of the potential use of civil airlines during national emergencies.

For the purpose of this study, civil airlines are defined as those publicly owned and operated country airlines which provide non-military passenger and cargo transportation. Figure 1 presents the location of Bangladesh, India and Pakistan.

3.0 RESEARCH METHODOLOGY

The research methodology used in this study is presented in Figure 2. The research methodology was divided into the following five tasks:

- i) Identify Study Parameters
- ii) Define Data Needs
- iii) Collect Data
- iv) Analyze Capabilities
- v) Evaluate Potential for Future Use.

i) Identify Study Parameters

To identify the study parameters, the project team used the scope of work as defined in the solicitations and in the contract as a base document. An understanding of this task was supplemented by a discussion of the objectives and scope of work with DIA. The understanding was enhanced by the project team's knowledge of the utilization of civil aviation in Bangladesh and on the Indian subcontinent during normal and emergency conditions.

ii) Define Data Needs

After identifying the study parameters, the project team defined the data needs to satisfy the objectives of the study using DIA's letter U-25-029 dated April 23, 1984 as a guideline. The data needs identified in this task included (a) inventory-type information about aircraft, airports, personnel, communication systems, and maintenance facilities and (b) historical data on the past use of Bangladesh Biman during emergencies. These data were used in evaluating and assessing civil aviation's ability to support Bangladesh military forces during national and war emergencies. Adequacy, completeness, and accuracy of the data was considered of prime importance for the purpose of this study.

iii) Collect Data

The project team identified a number of primary sources for data collection. These sources included a number of civil aviation publications and local newspapers of Bangladesh, both in English and in Bengali, with coverage around the dates of national emergencies. This information was supplemented by interviews with people in the U.S.A. who have knowledge of Bangladesh and Indian subcontinent civil aviation operations. Table 1 presents a list of libraries that members of the project team used for data collection.

iv) Analyze Capabilities

Analysis of the capabilities of Bangladesh civil aviation as presented in this report was based on (a) available data as collected in Task (iii), (b) the project team's knowledge of Bangladesh civil aviation matters, and (c) indirect inferences from interviews with people who have knowledge of the capabilities and the operating efficiencies of Indian subcontinent civil aviation operations.

Since the formation of the country in 1971, Bangladesh has not participated in any war to date and a review of local newspapers revealed little direct information on the use of civil aviation for military purposes. Except for mentioning the use of Bangladesh Defense Force aircraft and helicopters to drop relief goods and medical supplies in affected areas during heavy flood and monsoon seasons, there is very little news coverage in the local newspapers about the use of civil airlines. As a general rule in the Indian subcontinent, local newspapers do not cover the use of civilian aircraft for troop, equipment, and artillery movements for military security reasons. Such movements are considered too sensitive from a military strategy point of view to be mentioned in public newspapers. Therefore, to analyze the capabilities of civil aviation in Bangladesh, the project team relied mostly on their own experience in the operation of the Indian and Pakistan civil airlines and projected this information to apply to Bangladesh, giving due consideration to the geographic setting, geopolitical situation, internal operations, and operating efficiencies of the airlines and the people of Bangladesh.

v) Evaluate Potential for Future Use

The data analysis in Task (iv) formed the basis for the evaluation of potential future use of the airline. Several scenarios and purposes were evaluated. For a description of the assessment and the potential use of the airline for military purposes, refer to Sections 7.0 and 8.0, respectively.

4.0 LIMITATIONS OF THE STUDY

The operating history of Bangladesh Biman is only 13 years old; although it was formed in an era that is considered the age of information, very little public or open-file information is available on the airline's operations. Bangladesh is a member of the International Civil Aviation Organization (ICAO), but it does not have a resident representative and a search of Bangladesh files in the ICAO library revealed very little information directly applicable to the purpose of the study. Very little data on civil airlines/air services were available at the Bangladesh Embassy at Washington, D.C. The Biman office in London and the ticketing office in New York could not even provide an up-to-date route map of the airline. The research team relied mainly on information that was either several years old or indirect (manufacturer's specifications, aviation references) concerning the airline's equipment and facilities. While this information may be sufficient for the general purposes of this study, a more accurate assessment would require an information update in the form of field studies that were not included in the contract scope of work. Also, Bangladesh has a major water transport system that offers a cheap and, to an extent, weather-independent system of mass troop and equipment transfer. This study briefly describes the water transport resources of the country, but a full assessment of its potential use for military purposes would require additional studies.

5.0 CIVIL AIRLINES/AIR SERVICES IN BANGLADESH

5.1 General Overview

5.1.1 Origin and History

The civil aviation history of Bangladesh could be divided into two distinct phases: before and after the creation of

Bangladesh. During the pre-Bangladesh period, the first air mail and passenger service to the area was started in 1933 by Indian Trans Continental Airways and Imperial Airways. Both these airlines used Dragon and Fox Moth aircraft and made enroute stops at Chittagong on their flights between Calcutta and Rangoon. Later a direct service was established between Calcutta and Dacca. Within two years, due to financial difficulties, these services ceased operation. During the second World War, the whole area of Bangladesh became a warfront and a number of small airports were constructed to serve military needs. At the end of the war, two Indian airlines, Orient Airways and later Bharat Airways operated several routes between Calcutta-Dacca-Chittagong.

The Indian subcontinent was partitioned into India and Pakistan in 1947; Bangladesh formed the eastern wing of Pakistan. Because of the distance between the two wings of Pakistan and the need to maintain administrative, as well as trade links, between the two geographically separate wings of the country, the Pakistan Government took keen interest in developing air transportation. This Pakistan International Airlines (PIA) was formed to serve the east and the west wings of the country. By 1970, the PIA had become a major airline of the region with a fleet of twelve Boeing and ten Fokker Friendship aircraft that offered daily flights to Bangladesh. In addition to the PIA, that operated several flights from West Pakistan to East Pakistan (now Bangladesh), a number of foreign international carriers have also operated to and from Dacca, now the capital city of Bangladesh. Within the country, local flights were introduced to a number of principal cities including Chittagong, Cox's Bazaar, Comilla, Sylhet, Shamshearnagar, Ishurdi, Jessore and Thakurgaon. In the late 1960's, PIA also introduced STOL (Short Take Off and Landing) services with deHavilland Twin Otters that operated between towns and cities that had inadequate surface links. These services remained operational until December 1971, when the eastern wing of Pakistan declared its independence and Bangladesh emerged on the world map as a sovereign nation.

Shortly before the creation of Bangladesh in December 1971, most of the aircraft based at Dacca were transferred to West Pakistan. These aircraft included four F27s, four STOLs, and one helicopter. During the 1971 war with Pakistan military forces, which resulted in the creation of Bangladesh, Dacca and other principal airports of Bangladesh were heavily damaged. In late 1971, Bangladesh lacked aircraft to start civil aviation operations even though it had qualified staff and experience. Bangladesh began commercial air transportation by using a DC-3 aircraft from the Air Force, but this arrangement did not last very long as the plane crashed at Dacca airport during a training flight. The Government then leased two F27 aircraft from India and formed an airline that was later named Bangladesh Biman and became the country's flag carrier in civil aviation. Other aircraft were gradually added to the fleet, but it is still a modest fleet for an airline that is expected to serve a country with a population of 82 million.

5.1.2 Operating Environment

Banladesh is bounded on the west, north and east by a long land border with India; in the southeast it shares a short land and water border with Burma. On the south is a highly irregular deltaic coastline fissured by many rivers and streams flowing into the Bay of Bengal. The distinguishing characteristic of the geography of Bangladesh is its uniformity. The whole country is flat alluvial plain except for the Chittagong Hills in the southeast and the low hills of Sylhet in the northeast. A number of major rivers and their tributaries flow south toward the Bay of Bengal. During the monsoon season, winds from the Bay of Bengal develop as cyclones loaded with rain and blow inland at high velocities, resulting in heavy flooding. The rainfall varies from 50 to 200 inches per year. Floods and monsoons play a major role in disrupting local commercial aircraft operations. Heavy floods damage airports and high winds and high temperatures result in cancellation of flights for several days at a time.

5.1.3 Legal Framework

The Bangladesh Biman is a public corporation, established and operated under direct Government control. It functions administratively under the Aviation Division, Bangladesh Ministry of Communication. The management of the Corporation is delegated to a Board of Directors that is comprised of a Chairman and a maximum of four Directors, all appointed by the Government. The Board, under the direction of the Government, discharges its functions based on commercial considerations and regard for public interest. The principal function of the Board is to provide safe, efficient, adequate, economic and properly coordinated air transport services for the country. The shareholders of the Corporation do not have voting power and therefore have no control over the activities of the Corporation.

According to the Bangladesh Constitution, Parliament has overall legislative authority pertaining to civil aviation matters. Until the country develops its own civil aviation code, the governing law in Bangladesh is the Pakistan Civil Aviation Ordinance 1960 which provides for (1) the control of manufacture, possession, use, operation, sale, import and export of aircraft, (2) control and regulation of air transport service, and (3) the control and development of airports in the country. Constitutionally, during war or other national emergencies, the Government can take the following actions:

- o Cancel or suspend, either absolutely or subject to certain conditions specified in the order, all or any of the licences or certificates issued under this Ordinance
- o Prohibit, either absolutely or subject to certain conditions specified in the order, or regulate in such manner as may be specified in the order, the flights of all or any aircraft or class of aircraft over the whole or any part of Pakistan (Bangladesh)

- o Prohibit, either absolutely or conditionally, or regulate the construction, maintenance, or use of any aerodrome or airport, aircraft factory, flying-school or club, or place where aircraft are manufactured, repaired, or kept, or any class or description thereof

- o Direct that any aircraft or class of aircraft, aerodrome or airport, aircraft factory, flying school or club, or place where aircraft are manufactured, repaired, or kept, together with any machinery, plant, material, or things used for the operation, manufacture, repair, or maintenance of aircraft shall be delivered forthwith or within a specified time, for being placed at the disposal of the central Government, to such authority and in such manner as it may specify in the order.

According to the above provisions, the Government enjoys full authority over civil aviation matters at any time and can exercise this authority during national emergencies.

The operation of Bangladesh Biman and other functions related to civil aviation fall under the Department of Civil Aviation, which is responsible for providing the necessary infrastructure for civil air transport operations. The functions of the Department are divided into three categories - legislative, administrative and judicial. The legislative power grants the Government the right to (1) cancel any licence or prohibit or regulate the flight of all aircraft over Bangladesh and (2) control the use of any aircraft, airport or related facility in the event of war or emergency or in the interest of public safety. Administrative functions encompass day-to-day civil aviation operational matters, including formation of procedures and control of functions such as registration of aircraft, issuance of certificates of air worthiness, licensing of personnel, investigation of accidents and maintenance of airports. The judicial functions

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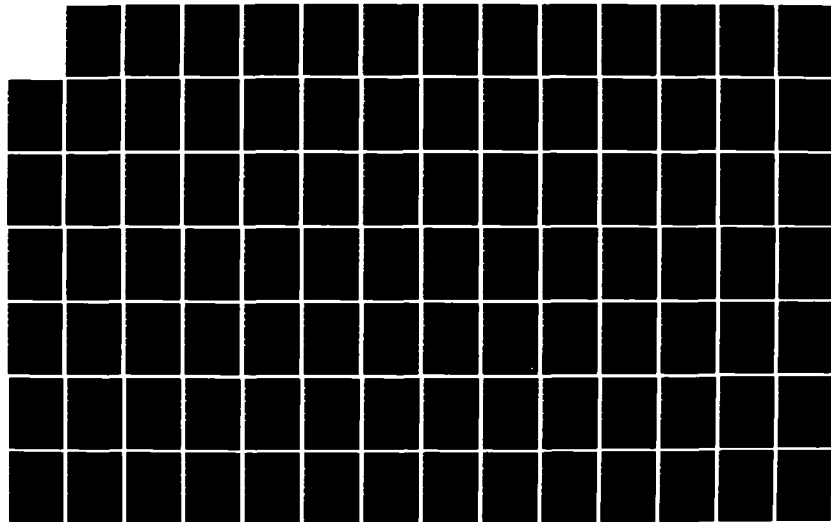
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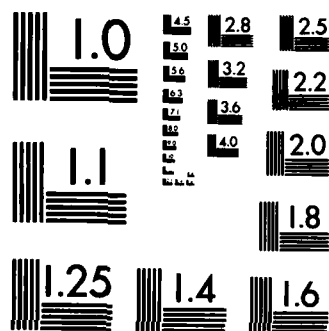
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include the legal aspects of the investigation of any accident arising out of or in the course of air navigation. The Department performs its functions through several divisions, each dealing with some particular aspect of civil aviation. These divisions include:

- o Air Traffic Services Division
- o Communication Division
- o Licensing Division
- o Planning Division
- o Air Transport Division
- o Aeronautical Inspection Division.

Each of these divisions is headed by a Director. Bangladesh does not have an Air Transport Licensing Board and, because of the lack of qualified staff, the above divisions sometimes operate at a reduced level.

5.1.4 Financial Position

Minimal publicly available information could be found on the latest financial position of the Bangladesh Biman. One source from the Bangladesh mission to the United States indicated that it is very unlikely that the Corporation would issue a public annual report on Biman operations. The research team was able to obtain a consolidated 1981 Profit and Loss Statement of Bangladesh Biman from ICAO records at Montreal. The significant financial data include the following:

Total Operating Revenue	U.S.\$ 89,234
Total Expense	
(including operating expense	
\$96,481, non-operating expense	
\$201, and interest \$1,792)	98,474
Loss	\$9,240

The major source of income was passenger traffic, which constituted 84 percent of revenues; major expenses were fuel (42 percent), maintenance and overhaul (9 percent), and landing and associated airport charges (13 percent of the total expense charges). The airline spends only 1.3 percent on salaries and 0.3 percent on crew training, which apparently makes it difficult for the airline to keep experienced and competent staff. After getting some experience, many reportedly seek employment with foreign airlines that offer more attractive salaries and training facilities. The airline spends 42 percent on fuel, which indicates fuel inefficiency probably due to the older aircraft. A tight financial position and a net overall loss in operations makes fleet replacement very difficult.

In order to modernize their fleet, Bangladesh Biman bought two DC-10-30 aircraft less than five-years-old from Singapore Airlines for \$23 million each. The Government of Bangladesh financed these loans through its nationalized commercial bank, the Sonalibank, which arranged the bulk of the \$46 million in seven- to eight-year loans from local and foreign resident banks representing mostly Middle Eastern interests. Bangladesh had difficulty in raising capital through European or U.S. sources according to the March 1984 Far Eastern Economic Review. Recently, the Bank of China provided a \$10 million long term loan to Bangladesh to buy a third DC-10 from Singapore Airlines. The major issue for any fleet expansion of Bangladesh Biman will be financing, which will determine what aircraft the Biman will buy in the future.

5.1.5 Key Personnel

Table 2 presents the names of the key personnel of Bangladesh Biman. The Biman management has fewer Bangladesh Air Force personnel on staff than India or Pakistan. One reason for this could be that the small Air Force has been in existence only

since the country came into being and has not produced enough retired senior Air Force personnel to assume responsible operational roles in the airline.

5.2 Flight Equipment and Facilities

5.2.1 Aircraft

Bangladesh has three organizations that own and operate aircraft: the civil airline Bangladesh Biman, the Government of Bangladesh, and a flying club in Dacca.

The principal operator of civilian aircraft, Bangladesh Biman, has 15 aircraft: 11 jets and four propeller aircraft. It was recently reported that a Biman F-27 was destroyed in an accident at Dacca. Table 3 presents an inventory of Bangladesh Biman aircraft. Tables 6 through 9 and Figures 3 through 6 present aircraft data and sketches.

The Bangladesh Government operates 16 single-engine aircraft. Table 4 presents an inventory of aircraft owned and operated by the Bangladesh Government. Tables 10 through 13 present data of Bangladesh Government aircraft.

The Flying Club at Dacca owns and operates one Grumman and three Cessna aircraft. These aircraft are basically used for training purposes. Table 5 presents the inventory of Dacca Flying Club aircraft.

5.2.2 Condition and Age of Fleet

The Bangladesh Biman operates Boeings, Fokkers and DC-10s. The manufacture dates of the Boeings range between 1966 and 1968; they were bought by Bangladesh in used conditions. The Fokkers are of the F27-600 and F28-4000 series; their manufacture dates range between 1970 to 1981. All of the Fokker aircraft except

two appear to be bought second hand. The Bangladesh Biman has three DC-10s with manufacturing dates of 1978, 1979 and 1983. Overall, the fleet is old and needs to be replaced by newer aircraft; Bangladesh appears to have limited resources for such replacements. The manufacture dates and delivery dates of various aircraft to Bangladesh Biman are presented on Table 3.

The manufacture dates and delivery dates of small and light aircraft operated by the Government and the Flying Club are not known, but they are considered to be old with an average maintenance record.

5.2.3 Facilities

Most of the aircraft operated by the Bangladesh Biman are considered to have standard on board facilities for communication, a warning system, and a deviation-alerting system. The DC-10s had major overhauls and modifications before delivery to the Bangladesh Biman by Singapore Airlines. These modifications have included installation of cruise-performance-improvement filters and the introduction of short fixed-core exhaust nozzles to improve the aerodynamic performance and fuel efficiency of the aircraft. A list of aircraft avionics standard package is presented in Table 16.

5.3 Civilian Airports

5.3.1 Location

Bangladesh has a total of nine civilian airports. Two airports, Dacca and Chittagong, are international airports; the remaining seven (Jessore, Sylhet, Comilla, Ishurdi, Thakurgaon, Saidpur and Cox's Bazaar) are smaller airports with no international traffic. Overall, the airport system of Bangladesh is geared towards a relatively small volume of air commerce. Internationally, the Bangladesh Biman connects Dacca with the Middle East,

the United Kingdom, Greece, Thailand, India, Pakistan, and Malaysia. Tables 14 and 15 and Appendix B present data on local Bangladesh airports. Figure 7 presents the location of civil airports in Bangladesh.

5.3.2 Major Airport - Dacca

Dacca is considered a major airport of Bangladesh. Table 14 presents data on this airport. Since 1973, Bangladesh has received or had commitments of financial assistance under the United Nation's Externally Financed Technical Cooperation Projects to improve airport facilities. These programs are in various stages of completion. Dacca Airport is equipped with Non Directional Beacon (NDB), VHF Omnidirectional Radio Range (VOR) and Instrument Landing System to aid in navigation and land approaches. It lacks modern ground facilities.

5.3.3 Minor Airport - Comilla

Comilla is an example of a minor airport of Bangladesh. It has smaller runways and could accommodate only smaller aircraft such as Fokkers. It is reported that it does not have any maintenance or fuel facilities and is not suitable for night landing. Table 15 presents data on Comilla Airport.

5.3.4 Military Airports

All civilian airports in Bangladesh are jointly used by the Bangladesh military as there are no separate military airports.

5.3.5 Maintenance and Airport Construction

Construction and maintenance of airports are performed by the Airport Development Agency. This agency consists of technically skilled personnel who coordinate their functions with the Director General of Civil Aviation. All airports in Bangladesh

are Government owned, operated, and maintained. In the past, the Airport Development Agency has received assistance under the United Nations Technical Cooperation Project for airport development at Dacca. The present status of these aid programs could not be confirmed from publicly available literature.

5.4 Personnel

5.4.1 Staff Categories

The categories of staff that operate Bangladesh Biman are similar to India or Pakistan airlines' categories. Personnel consist of pilots, copilots, other cockpit personnel, and support staff. Bangladesh Biman is reported to have 4,500 staff which include the following:

Pilots	100
Cabin Attendants	300
Other Cockpit Personnel	50
Maintenance and Overhead Personnel	900
Support Ticket and Sales	650
Other Personnel	2,500
 TOTAL	 4,500

As a Government corporation, Bangladesh Biman jobs appear to be prizes for favored non-technicals that represent the 70 percent of staff concentrated in support, sales, and promotion activities. This creates an inefficient and bureaucratic system. As a young airline, Bangladesh Biman has a greater percentage of young staff and their level of education is comparable to India and Pakistan. A great majority of staff are reported to be direct hires rather than transfers from the Air Force; therefore the Bangladesh Biman staff is more geared for peace time operations.

5.4.2 Training

During the pre-Bangladesh days, most training facilities were located in West Pakistan; after the formation of Bangladesh Biman in 1973-74, Bangladesh received assistance from ICAO/United Nations Development Project to establish pilot testing and facilities for aircraft operation, air traffic control, communication operations, and airport fire fighting. In 1979, the Australian Government provided assistance in establishing management training for airline operations. More recently, Singapore Airlines, after selling their three DC-10s, provided extensive training in complete DC-10 operation to Bangladesh Biman technical crew, ground engineers, maintenance staff and cabin crews. The Singapore Airlines training included class room and on the job training over five major areas including airframe, engineering, electronics, instruments, and radio operations.

Overall, civil aviation training facilities available in Bangladesh are very restricted and the level of training is limited to equipment on hand which makes them capable of handling only routine civil airline operations. As Bangladesh has never faced a war situation, the Bangladesh Biman staff has no actual experience in war emergencies. Provision of training for anticipated war emergencies, if any, could not be ascertained from public sources.

5.5 Communication Systems

The communication system in Bangladesh, although not very advanced, covers more or less the entire country in some form. This system includes:

- o Telephone
- o Teleprinter
- o Single Select Band Radio
- o Aeronautical Fixed Telecommunication Network
- o Wireless Communication
- o Courier

During peacetime and during emergencies, civil airlines and other Government organizations communicate with each other through one common or a combination of services. Bad weather and cyclones play a major role in retarding the flow of communications. The Government, for the last several years, has been trying to improve communication networks with foreign assistance to make them more reliable during bad weather. During national emergencies, military communication requirements take precedence over all other needs and, within the limitations of the system and weather, the communication flows speedily among various Government and civil agencies.

5.5.1 Avionics and In-Flight Communications

A list of standard avionics on board of Bangladesh Biman aircraft is presented in Table 16. It is difficult to ascertain from public sources how much of the equipment is actually present or operational on various aircraft of the Bangladesh Biman fleet.

5.5.2 Ground Communication and Navigation Aids

A list of available navigational aids for various airports is presented on Tables 14 and 15 and in Appendix B. Except at Dacca and Chittagong, night landing facilities are inadequate at the airports in Bangladesh .

Overall, the airports in Bangladesh are provided with bare minimum air traffic communication facilities which, at most of the airports, restricts aircraft operation to daytime and fair weather conditions only.

For the purpose of establishing and providing air traffic control services, the entire airspace of Bangladesh constitutes one Flight Information Region known as Dacca FIR. All aircraft, civil or military, entering Dacca FIR boundaries are required to

contact Dacca Flight Information Center on an appropriate frequency at least ten minutes before crossing the boundary. The Dacca Approach Control Office is responsible for providing air traffic services within Dacca control zone, which extends from the ground level to Flight Level 450 (45,000 feet). Chittagong control tower provides air traffic services within the Chittagong control zone, which extends from the ground level to Flight Level 150 (15,000 feet). In addition to these control zones, Bangladesh has several advisory routes along which air traffic advisory service is provided to various flights. The advisory routes are not considered controlled airspaces.

For the purpose of exchanging information on aviation matters, Dacca and Chittagong airports are connected with the rest of the world through an Aeronautical Fixed Telecommunication Network. All airports that are used by scheduled air services are provided with radio-navigational aids and a direct VHF air-ground communication system in addition to conventional signals, if available. There is a direct air-ground high frequency long range communication channel operating around the clock at Dacca Airport. Pilots are required to report the performance of all radio communication navigation systems in a post flight information report.

Meteorological information is provided by the Director of Meteorological Service, whose main offices are located at Dacca and Chittagong. These offices are responsible for the collection and dissemination of information for advance meteorological planning, area watch, and issue of warnings. Other meteorological offices are located at Cox's Bazaar, Jessore, Ishurdi and other airports that serve domestic flights.

5.6 Maintenance Facilities

5.6.1 Capacity and Capability

Bangladesh has limited maintenance facilities that are reported to be located at Dacca. In 1979, the Australian Government provided assistance to Bangladesh Biman to design and construct a maintenance hangar and engineering facilities at Dacca. The present status of this project could not be verified through public sources. Before the purchase of DC-10s from Singapore Airlines, these aircraft underwent 12,000 hours of structural sampling inspection, component changes, seat reconfiguration, and a compass swing check. During the first six months of DC-10 operations, Singapore Airlines maintenance staff trained Biman staff in routine maintenance of the aircraft. It appears that Bangladesh Biman is equipped for routine aircraft maintenance, but has to rely on outside sources for major checks. They turn to India for general check ups, Singapore for DC-10s, and Hong Kong for Boeings, which accounts for the high maintenance and overhaul expenses in their financial statement.

5.6.2 Availability of Spare Parts

Procurement of spare parts for aging aircraft has been a problem for Bangladesh Biman. The airline is reported to have a \$10 million spare parts package deal with Singapore Airlines on credit terms. According to an industry spokesman, Bangladesh Biman has severe problems in procuring spare parts for the 707s. The delay or non-availability of spares for smaller aircraft may reduce their operational effectiveness during national emergencies.

5.7 Civil/Military Interface

As in most countries of the world, the civil airline in Bangladesh is also recognized as a back up for military opera-

tions during national emergencies. Civil aircraft supplement the military's troop and equipment carrying capabilities. Logistic mobility has always been a decisive factor in any armed conflict; this mobility is achieved through air carriers. The Bangladesh civil airline could cooperate and interface with the military during peace time and during national emergencies, depending on the situation and operational needs.

5.7.1 Civil Military Interface - Peacetime Conditions

There is a close coordination between the Civil Aviation Department and the Ministry of Defense in respect to air traffic control and flight information systems. In addition, most of the civilian airports in Bangladesh are used jointly by civil and military aircraft. The Bangladesh Air Force is responsible for all aerial search and rescue operations including civilian rescue and searches. The Meteorology Ministry, which is responsible for providing all essential weather information and forecasts, is under the Bangladesh Ministry of Defense. In case of internal disturbances or riots, the responsibility for safeguarding airports and civil aviation installations rests with the police and the military. In the past, there has been close cooperation during major internal disturbances in the country.

5.7.2 Civil Military Interface - National Emergencies

Since the formation of Bangladesh, the country has not been involved in a war. Therefore, it is difficult to predict the actual flow of events that would take place between the Bangladesh Biman and the military to handle war emergencies. As the basic structure of the Bangladesh Biman is similar to Indian Airlines and Pakistan International Airlines, it is expected that the basis of cooperation, command, control, and communication will be the same as in India and in Pakistan. It could not be ascertained from public sources whether the Bangladesh Ministry of Defense has a plan to handle any such anticipated emergency.

In a war emergency, depending on its severity, a state of emergency would be declared and armed forces would move in to take control of airports and civil aviation installations. Commercial flights would be stopped or restricted and military needs would take precedence over all other needs. As in India and in Pakistan, the Bangladesh Ministry of Defense would first use their own resources and alternate sources such as railways and water transport that are comparatively cheaper than using civilian aircraft. Use of Bangladesh Biman might be limited because a majority of airports are not suitable for night landing, do not have fuel storage capabilities, and could land only smaller commercial aircraft due to short length of runways.

5.8 Future Outlook of Airline

Expansion of the fleet or facilities of Bangladesh Biman Airlines is tied to financing issues. So far, Bangladesh Biman has faced constant problems in raising enough money to modernize their fleet. In view of the continuing non-profitability of the Corporation, financing could only be obtained with Government backing and the ability to repay. This situation is not expected to change drastically in the near future. Airport expansion plans are also dependent on foreign government aids and loans that are tied to the lending country's own economic conditions and their political interest in Bangladesh. Overall, progress in the civil aviation area is expected to be very slow in the near future.

5.9 Military Aircraft

5.9.1 Air Wing - Bangladesh Defense Force

The Air Wing of Bangladesh Defense Force has 26 combat aircraft and 3,000 personnel, all volunteers. The Air Wing has one interceptor squadron with the survivors of nine Russian built single-

seat Mikoyan-Gurevich MiG-21MF fighters and two two-seat MiG-21U trainers. In addition, Bangladesh has two fighter/ground attack squadrons with the survivors of 36 J-6 fighters acquired from the People's Republic of China. The Air Wing Squadrons are based at Tezgaon, Dacca, and Jessore.

The remaining Air Force strength is comprised of transport aircraft, utility helicopters and trainers. Bangladesh has only one transport squadron which consists of four Russian Antonov An-12, one Antonov An-24, and three An-26 aircraft, and one DC-6 aircraft. The helicopter squadron operates Russian equipment, such as Mi-1, Mi-4 and Mi-8 helicopters, as well as U.S. built Bell Model 212 and French Aerospatiale Alouette III helicopters that were acquired from India.

It is reported that the operating efficiency of the Bangladesh Air Force is hampered by non-availability of spare parts, most of which come from the U.S.S.R. For the last few years the country has been leaning towards China for the supply of equipment. The Bangladesh Air Force already has a number of China built J-6 fighters and the problem of spare parts non-availability is expected to improve in the future.

A list of Bangladesh Air Force equipment is presented on Table 17. Table 18 compares the men and equipment carrying capacity of military aircraft with civilian aircraft.

6.0 OTHER TRANSPORTATION SYSTEMS

The transportation system in Bangladesh is quite rudimentary although different and distinct modes of transportation do exist. The other major modes of transport are by water (boats), and by land (railways, buses, and/or trucks). Figure 8 presents principal railway and road systems of Bangladesh.

6.1 Water Transport

Because of the flat terrain and a number of major and tributary river systems in Bangladesh, transportation by water accounts for about 75 percent of the movement of goods and people. During the flood season, large areas become completely dependent upon water transport. There are several reasons that water is the major mode of transportation: (1) extensive river systems exist throughout the country, (2) wet and sticky soil conditions pose difficult foundation problems for the construction of railways, bridges, and roads, and (3) embankments for roads and railways block natural drainage and cause flooding.

The major river ports include Dacca, Narayanganj, Chanpur, Barisal and Klulna. Coastal shipping and ferry boats operate between Chittagong, Cox's Bazaar, Narayanganj and Klulna. According to Nyrop et al, 1975, there are about 5,000 miles of navigable inland waterways; about 65 percent could be used throughout the year. Regular river steamers operate along 50 percent of the navigable waters. The principal water crafts include steamers, motor launches, ferryboats, barges and country boats. All inland water transport in Bangladesh is regulated by the Bangladesh Inland Water Transport Authority.

Bangladesh also has a small merchant marine consisting of cargo ships with servicing facilities at Chittagong and Chalna sea-ports.

6.2 Land Transport

6.2.1 Bangladesh Railways

The second most important means of transportation is the Bangladesh Railway System. It was developed as a part of the Indian subcontinent railway as early as 1894. Since then, rail lines have operated between Dacca, Narayanganj, Mymensingh,

Chittagong and Sylhet. During World War II, the railway system was used extensively by the military. There are about 1,800 miles of railway tracks that cross 3,600 bridges and about 470 railway stations spread throughout fifteen of the nineteen districts of Bangladesh. About 70 percent of railway route mileage is meter gauge and 30 percent is broad guage, which lies mostly in the western part of the country. Most of the rail lines in Bangladesh run parallel to the river system in a north-south direction; many freight and passenger journeys include a combination of rail and water transport. According to one estimate, Bangladesh Railway has about 1,200 passenger and 21,000 freight cars and the system is capable of handling 1,000 million freight ton-miles and 2 billion passenger miles per year. At several points along the India-Bangladesh border, the Bangladesh Railway system interconnects with the Indian Railway System. In the past, Bangladesh Railway has received several loans from the Asian Development Bank for the rehabilitation of their track system.

6.2.2 Buses/Trucks

Bangladesh does not have a well developed national and unified road system. There are about 2,500 miles of major roads; about 1,500 miles of unrelated roads; and several thousand of miles of smaller roads that crisscross the country side. These roads require constant maintenance and often break off at riverbanks during floods or heavy rains. Bangladesh Road Transport Corporation is responsible for operation and permitting of all vehicles. The trucking industry is not fully developed because of the lack of technical knowledge, labor unrest, and high fuel costs. All vehicles must be registered; there is a major concentration of registered vehicles in Dacca, Chittagong and Sylhet. As in India, the bus/truck companies operate with a high profit margin and no regard for maintenance. This makes their potential for emergency use very unreliable.

7.0 ASSESSMENT FOR THE FUTURE USE OF CIVIL AIRLINE DURING EMERGENCIES

7.1 Emergency Scenarios

Most of Bangladesh is a flat delta of deposited soils. The dominant feature of the plain is the profusion of river systems flowing north to south. Rainfall averages about eighty-five inches annually, and in places is among the heaviest in the world. The rain is brought primarily by the southeast monsoon winds off the bay from June through September. During these months, winds from the Bay of Bengal develop as cyclones loaded with rain and blow inland at a high velocity, resulting in calamitous flooding. Most of the people of Bangladesh, predominantly Muslims, live in the 71,000 or more small agricultural villages; only 4 to 5 percent live in cities. The population of Bangladesh (about 82 million) is predominantly young; these young Bengalis played a major role in the 1971 war with Pakistan. With this background, a number of emergency scenarios could be examined in which the civil airlines could be called upon to provide assistance to the military. These include:

- o Assistance during natural disasters
- o Assistance in handling internal disturbances
- o Assistance in national defense.

7.1.1 Assistance During Natural Disasters

The principal river systems of Bangladesh play a primary role in the economic and social life of the country. The river systems provide drainage, determine the kind and extent of agricultural production, furnish vast supplies of fish, and provide inland waterways for cheap transportation. At the same time, the seasonal heavy flooding generally brings widespread loss of life, crops and property. Cyclones from the bay occasionally intensify

seasonal flooding to the point of causing major natural disasters. Some of the major natural disasters include cyclones of May 1963 with 20,000 casualties; cyclones of May and June 1965 with 47,000 casualties; a major cyclone and tidal wave of November 1970 in which 300,000 lives were lost; high winds and flooding of October 1974, resulting in acute food shortages; and floods of October 1975. Newspaper coverage describing the role of civil aviation during these emergencies is very brief. For example, Sangbad, a Bangladesh newspaper, carried the following news item in its August 1, 1970 issue:

"In order to distribute relief goods to the flood affected areas of (then East Pakistan), (army) troops have been deployed. Army troops were sent to Pabna and relief goods were dispatched to flood-affected areas of Dacca district by plane. Army helicopters carried food and relief goods to the different flood hit areas."

Civilian aircraft were used to carry medical supplies and relief goods from the west wing of Pakistan to Bangladesh (then East Pakistan). In 1974 and 1975 they again transported supplies as a goodwill gesture towards Bangladesh by the Government of Pakistan.

The life of the riverine country is keyed to a rough balance between the enormous volumes of water received from rain and the northern river input, and the capacity of the river system to handle this volume. Although an extensive water management program is underway, its completion is generally dependent on foreign aid. Until these programs are completed, river systems and cyclones will keep on bringing devastation to the area and, if airports are in operation, civilian aircraft will be used to supply medical aid and emergency essentials to the affected areas. For these services, no major conversion of the aircraft will be necessary to provide assistance during natural emergencies.

7.1.2 Assistance in Handling Internal Disturbances

Bangladesh is one of the most densely populated areas in the world; within the country Dacca and Camilla have the highest population densities with about 2,500 persons per square mile. Rangpur, Bogra, Pabna, Kushtia, Jessore, Barisal, Faridpur, Mymensingh, Tangail, Noakhali and Chittagong have an average of 1,500 persons per square mile. The population of the country is predominantly young; nearly 50 percent are under the age of twenty-five. The younger generation has always been in the forefront of the political activity and agitation since the early twentieth century, when the demonstrations were against the British. Later, this unrest continued against undivided Pakistan and in 1972 against the Government of Mujib, the Prime Minister, and later the President of Bangladesh. This political unrest, added to the low educational level (literacy is slightly over 20 percent), stagnant economy, corruption in civil ranks, uncontrolled inflation, and low per capita annual income (about US \$70.00), occasionally results in the eruption of fierce riots and clashes with police and national security forces. Where airports are available, civil aviation would offer a speedy transfer of military or a reinforcement of police troops to subdue rioters and restore law and order. Troop movement could also be accomplished by a combination of air, road, and water transport.

7.1.3 Assistance in National Defense

A national defense emergency could arise when the security of Bangladesh is threatened by either external or internal forces. Civil aviation could be called upon to move troops to conflict areas. In a military role, the DC-10s, Fokkers, and Boeing B707-Bs could transport troops, their essential equipment, and very limited cargo. The Bangladesh Biman has experience in seat conversion, as they do this routinely to accommodate more passengers during the Haj pilgrimage.

Runway lengths could be a limiting factor, however, in the use of civil aircraft in a national defense emergency. The DC-10s and Boeings could operate only from Dacca and Chillagong airports. The F27, which is built for operating on short or unimproved runways, can serve all the airports; the F28, which has slightly larger seating capacity and requires approximately 5,000 feet of runway, can probably land at most of the airports. However, the use of the F28s is hampered by the hot temperature in the summer months.

Fuel availability is also a limiting factor, as many airports do not have fueling facilities.

Table 18 presents a comparison of the troop and equipment carrying capabilities of Bangladesh Biman and Bangladesh Defense Force aircraft.

In case of a national emergency, the military could also use the light Government owned aircraft in an observational role. These aircraft are all capable of operating from short runways, dirt runways, or even from open fields and farms.

8.0 POTENTIAL USE OF CIVIL AIRLINES FOR MILITARY PURPOSES

8.1 Potential Use for Military Purposes

Bangladesh shares a long border with India and a small land and water border with Burma. To a large extent, Bengalis owe the creation of Bangladesh to India and their relations with India are considered good. During the 1971 civil war with Pakistan, nearly 10 million Bengalis took refuge in India and Indian armed forces trained and equipped the Bengali freedom fighters. India provides financial assistance to Bangladesh and has assisted Bangladesh with border demarcation, development of the jute industry, and Farakka Barrage project issues.

At the present time, a war between Bangladesh and India or Burma is unlikely, but it could be a future possibility as a result of superpowers' global political and military action. Bengalis are predominantly Muslims and, in spite of apparent good relations with their Hindu neighbor, have an undercurrent of latent Bengali nationalism and a desire to merge Bangladesh with the adjacent Indian state of West Bengal, which has a predominantly Bengali population. Border smuggling could also cause a strain in Bangladesh and India relations. Public sources do not mention the smuggling situation.

Bangladesh Biman could be called upon to support the military in a national emergency by providing its equipment and personnel to transport troops and light equipment during the initial stages of war. The civilian aircraft could also airlift ammunition and limited military cargo or medical supplies from a foreign country to Bangladesh.

8.2 Response Planning

Response planning determines how quickly the civil airlines/air services could be ready to respond to military needs. Bangladesh Biman is a civilian airline; in their short history they have never been called upon to perform in war emergencies. The Bangladesh Biman staff is reported to be mostly civilian employees with no military background and no training in war emergency operations. Therefore, compared to India or Pakistan, their response time is expected to be greater, particularly in the early stages of an emergency, and confusion is expected to play a negative role in their overall coordination and communication efforts.

8.3 Readiness Posture

The Bangladesh Air Force and Bangladesh Biman operate in two distinct areas of responsibility. They do share airports and other facilities, meteorological information, and rescue and search operations, but a line of demarcation between military and civilian functions is clearly established in the minds of Bangladesh Biman staff. Formal indoctrination and training of civil aviation personnel for participation in possible military actions is not evident from publicly available sources. During emergencies it is expected that the military will assume the decision-making role, but because of the bureaucratic nature of Bangladesh Biman, staff may lack the discipline for a speedy response and readiness posture.

8.4 Personnel Experience

As mentioned in Section 5.4, most of the staff of Bangladesh Biman is reported to have come from civilian backgrounds and gradually assumed greater responsibility in the airline after the senior officials of Pakistan International Airline left in 1971. This staff has performed routine peacetime airline functions and has recently been trained in more sophisticated DC-10 operations by the Singapore Airlines. Their training for emergency operations has been restricted to civilian emergencies such as equipment failure, bad weather, and disturbance aboard the aircraft. There is no cross training of Bangladesh Air Force personnel on civilian aircraft operations; the military is reported to confine training for emergency operations to their own aircraft, which include Soviet MiG 21s, Chinese Shenyang, and military transport aircraft such as the Antonov and DC-6. Although the present joint use of airports by the Bangladesh Biman and the military is helpful, the airline personnel do not seem to have training or experience in an extensive joint operation.

8.5 Effectivity and Confidence Levels

Hossain, 1977, in explaining Bangladesh Biman's failure to break-even since its inception, writes that the operating losses of Biman are due primarily to the lack of adequately trained personnel and the resulting inefficiency and mismanagement. The project research team has found no evidence during this study to indicate that planning, training, and support is provided to prepare the civilian airline personnel to participate in military operations. While some individuals on the Bangladesh Biman staff may be prepared to operate beyond the call of duty in a national emergency, the comprehensive use of the Bangladesh Biman for military purposes appears to be of limited effectiveness, at least in the early stages of a war emergency.

Table 1 LIST OF LIBRARIES USED FOR DATA COLLECTION

TWA	New York
Pan Am	New York
UNO	New York
Douglas Aircraft Co.	Long Beach, California
Library of Congress	Washington, D.C.
United States Central Intelligence Agency	Washington, D.C.
Bangladesh Embassy	Washington, D.C.
JPRS	Arlington, Virginia
University of California	Berkeley, California
Southeast Asian Studies	Berkeley, California
International Civil Aviation Organization	Montreal, Quebec, Canada
Air & Space Law-McGill Univeristy	Montreal, Quebec, Canada
Woodward-Clyde Consultants	Walnut Creek, California
Woodward-Clyde Consultants	Wayne, New Jersey

Table 2 Key Personnel of Bangladesh Biman Airlines

Managing Director - Manzoor-ul-Karim
Deputy Managing Director - M. Wahidullah
Director of Administration - Lt. Col. (Ret.) M. Z. Abedin
Director of Customer Services - Azimuddin Ahmed
Director of Flight Operations - Capt. Mazharul Haq
Director of Public Relations - M. Tajul Islam
Director of Marketing and Sales - M. A. Rouf
Director of Finance - Q. A. Zaman
General Manager - Internal Auditing - S. R. Ahmed
General Manager - Marketing and Sales - K. A. Azad
General Manager - Customer Services - M. A. Bari Mian
General Manager - Special Projects - Wing Commander (Ret.) S. W. Nabi
Deputy Chief Engineer - Central Engineering - M. Hasnat
Deputy Chief Engineer - Production - A. F. M. Humayun Kabir
Deputy Chief Engineer - Inspection & Quality Control - A. M. Huq
Deputy General Manager - Stores & Purchasing - C. M. Yusuf
Secretary - Shamsul Islam

Table 3 Flight Equipment and Facilities -
Bangladesh Biman Airlines Fleet

<u>Type</u>	<u>Serial No.</u>	<u>Date of Manufacture</u>	<u>Date of Delivery¹ To This Operator</u>
Boeing 707-351C	19168	07/66	12/73
	19434	30/67	02/77
	19776	07/68	09/78
	18921	08/65	08/80
	-321B 20018	11/68	01/82
	-369C 20085	11/68	01/82
Fokker F27-600	10438	06/70	09/72
	10453	02/71	09/72
	10477	02/72	10/73
	10442	09/70	11/73
	F28-4000 11172	07/81	09/81
	11180	09/81	10/81
MDD DC-10-30	46993	11/78	08/83
	46995	04/79	09/83
	47817	11/83	01/84

¹Date of delivery includes lease of equipment prior to purchase date.

Source: World Airline Fleets

Table 4 Flight Equipment and Facilities -
Bangladesh Government Fleet

<u>Type</u>	<u>Serial No.</u>	<u>Date of Manufacture</u>	<u>Date of Delivery To This Operator</u>
(8) DHC-2 Beaver		(Unknown)	
(2) Grumman G-44			
(4) Fletcher FU-24-950			
(1) Pilatus PC-6/BI-H2			
(1) Piaggio P 166L-2			

Table 5 Flight Equipment and Facilities -
Bangladesh Flying Club

<u>Type</u>	<u>Serial No.</u>	<u>Date of Manufacture</u>	<u>Date of Delivery To This Operator</u>
Grumman G-44A	145I	(Unknown)	
Cessna 150D	60409		
150G	65761		
182F	54986		

Table 6 Flight Equipment and Facilities

GENERAL AIRCRAFT DATA

Aircraft Type: Boeing 707

Models: -251C/-321B/-369C

Engines: Four Pratt and Whitney JT3D-3B

Dimensions:	Wing Span	Length	Height
	145 ft. 9 in.	152 ft. 11 in.	41 ft. 7 in.

Weights (lbs):	MXTOW	Empty	MXLND	MXPYLD	Fuel Cap.
-320B	327,000	140,000	207,000	50,000	166,529
-320C	335,000	138,000	247,000	96,000	166,529

Seats:	Maximum	Typical
	189	121

Cargo Capability: Volume 1,700 cu. ft. in belly
 8,000 cu. ft. on upper deck
 96,000 lbs. maximum

Maximum Range - With Maximum Payload:	-320B - 6,160 mi.
	-320C - 4,235 mi.

Runway Requirements:	Balanced Field Length	10,720 ft.	11,220 ft.
	Typical Minimum Runway Length -	8,000 ft.	8,000 ft.
	Minimum Runway Bearing Strength -	N/A	N/A

Special Features or Restrictions: These aircraft will not be permitted to operate in many areas of the world such as the United States and Europe after 1985, when ICAO noise regulations become effective. Individual countries, such as Bangladesh, may elect to override the ICAO regulations in their own country.

The 0321B model is a strictly passenger version of the B707. Its military role would be limited to troop transport plus belly cargo. The -351C and -369C models are convertibles which can be used in either cargo or passenger configuration.

Table 7 Flight Equipment and Facilities

GENERAL AIRCRAFT DATA

Aircraft Type: Fokker F27

Models: -600

Engines: Two Rolls Royce Dart 532-7 (same as F27 mk 400)

Dimensions:	Wing Span	Length	Height
	95 ft. 2 in.	77 ft. 3.5 in.	27 ft. 11 in.

Weights (lbs):	MXTOW	Empty	MXLND	MXPYLD	Fuel Cap.
	45,000	24,720	41,000	14,193	9,090

Seats:	Maximum	Typical
	48	44

Cargo Capability: 297 cu. ft.

Maximum Range - With Maximum Payload: 1,197 n. mi

Runway Requirements:	Balanced Field Length -	3,240 ft.
	Minimum Runway Length -	2,310 ft.
	Minimum Runway Bearing	
	Strength -	15 LCN

Special Features	Capable of operation on grass, dirt, or
or Restrictions:	gravel runways.

Table 8 Flight Equipment and Facilities

GENERAL AIRCRAFT DATA

Aircraft Type: Fokker F28

Models: -4000

Engines: Two Rolls Royce Spey 555-15

Dimensions:	Wing Span	Length	Height
	82 ft. 3 in.	97 ft. 1.75 in.	27 ft. 9.5 in.

Weights (lbs):	MXTOW	Empty	MXLND	MPYLD	Fuel Cap.
	73,000	38,683	69,500	17,000	23,080

Seats:	Maximum	Typical
	85	65

Cargo Capability: 560.22 cu. ft in belly

Maximum Range - With Maximum Payload: 1,125 n. mi.

Runway Requirements:	Balanced Field Length:	5,200 ft.
	Minimum Runway Length:	
	Minimum Runway Bearing	
	Strength:	20 LCN

Special Features	Capable of operating on unimproved runways
or Restrictions:	of gravel or grass.

Table 9 Flight Equipment and Facilities

GENERAL AIRCRAFT DATA

Aircraft Type: McDonnell Douglas DC-10

Models: -30

Engines: Three General Electric CF6-50C

Dimensions:	Wing Span	Length	Height
	165 ft. 4.4 in.	182 ft. 1 in.	58 ft. 1 in.

Weights (lbs):	MXTOW	Empty	MXLND	MPYLD	Fuel Cap.
	572,000	267,197	403,000	106,550	244,550

Seats:	Maximum	Typical
	380	255

Cargo Capability: with lower galley 3,696 cu. ft.
 with upper galley 5,490 cu. ft.

Maximum Range - With Maximum Payload: 4,000 n. mi.

Runway Requirements:	Balanced Field Length:	10,400 ft.
	Minimum Runway Length:	5,350 ft.
	Minimum Runway Bearing Strength:	N/A

Special Features or Restrictions: Limited cargo capability.

Table 10 Flight Equipment and Facilities

GENERAL AIRCRAFT DATA

Aircraft Type: DeHavilland DHC-2 Beaver

Models: --

Engines: One Pratt & Whitney R-985 Wasp Junior (9 cylinder radial air-cooled engine)

Dimensions:	Wing Span	Length	Height
	48 ft.	30 ft. 4 in.	9 ft.

Weights (lbs):	MXTOW	Empty	MXLND	MPYLD	Fuel Cap.
	5,200	3,000	5,100	2,100	635

Seats:	Maximum	Typical
	7	7

Cargo Capability: Door permits pieces of freight as long as 10 ft. to be loaded. Also a 45 gallon drum.

Maximum Range - With Maximum Payload: 483 n. mi.

Runway Requirements: Minimum Runway Length: 1,015 ft.

Special Features or Restrictions: Can be equipped with floats for water operations. Short takeoff, unimproved runway capability.

Table 11 Flight Equipment and Facilities

GENERAL AIRCRAFT DATA

Aircraft Type: Piaggio P-166-L-2

Models: --

Engines: Two Lycoming IGSO-540 (piston engines)

Dimensions:	Wing Span	Length	Height
	44 ft. 4 inc.	39 ft. 3 in.	16 ft. 5 in.

Weights (lbs):	MXTOW	Empty	MXLND	MPYLD	Fuel Cap.
	9,036	4,960	8,377	2,571	2,412

Seats:	Maximum	Typical
	10	5 (in executive version)

Cargo Capability: Maximum Payload 2,571

Maximum Range - With Maximum Payload: 930 n. mi

Runway Requirements: Minimum Runway Length: 1,930 ft.

Special Features None.
or Restrictions:

Table 12 Flight Equipment and Facilities

GENERAL AIRCRAFT DATA

Aircraft Type: Fletcher FU24-950

Models: --

Engines: One AVCO Lycoming IO-720-A1A (piston engine)

Dimensions:	Wing Span	Length	Height		
	42 ft.	31 ft. 10 in.	9 ft. 4 in.		
Weights (lbs):	MXTOW	Empty	MXLND	MPYLD	Fuel Cap.
	4,860	2,620	N/A	2,320	450
Seats:	Maximum		Typical		
	9 (utility version)		2 (agricultural version)		
Cargo Capability:	2,320 lbs. in agricultural configuration				
	1,400 lbs. in utility version				
Maximum Range - With Maximum Payload:	383 n. mi.				
Runway Requirements:	Minimum Runway Length: 1,280 ft.				
Special Features or Restrictions:	This aircraft is intended primarily for agricultural spraying and is probably configured as such in the Bangladesh fleet. It is available in a utility version, but must be purchased that way. The agricultural version can not easily be field-converted to a utility version.				

Table 13 Flight Equipment and Facilities

GENERAL AIRCRAFT DATA

Aircraft Type: Pilatus PC-6/B1-H2

Models: --

Engines: One Pratt & Whitney of Canada Pt6A-27 Turboprop

Dimensions:	Wing Span	Length	Height
	49 ft. 8 in.	35 ft. 9 in.	10 ft. 6 in.

Weights (lbs):	MXTOW	Empty	MXLND	MXPYLD	Fuel Cap.
	4,850	2,685	4,850	2,165	1,120

Seats:	Maximum	Typical
	11	8 (7 paratroopers)

Cargo Capability: Large door permits loading freight items up to
16 ft 5 in. in length. Total useable cargo
volume is approximately 107 cu. ft.

Maximum Range - With Maximum Payload: 566 n. mi

Runway Requirements: Minimum Runway Length: 770 ft.

Special Features Short takeoff capability and unimproved
or Restrictions: runway capability.

Airport Name/Code: Tezgaon (DAC)

Temperature Data: N/A **Field Elevation:** 24 ft. MSL

NAVAIDS/Lighting: NDB; ATC Control Tower; ground control approach lights; high intensity runway lights (HIRL); VASI.

Operator:
Services Available: Light maintenance available

Types Available	Grade 100 low lead (limited quantity), Jet A-1, JP-4 (military specification)
Storage Volume	Unknown
Delivery System	Unknown

Based Aircraft: Types Number
All aircraft listed in Tables 3 through 5 are
based at this airport

Special Features or Comments:	Not allowed as an alternate airport, no night stops.
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Table 15 Civilian Airports

Airport Name/Code: CLA

Location:	(City)	(Geo Coordinates)
	Comilla	N 2326.2 / E 09111.5

Temperature Data:	N/A	Field Elevation:	25 ft. MSL
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Runways:	Orientation:	16/34
	Length/Width	5,000 X 75
	Surface Type/Strength:	Asphalt (Bitumen)

NAVAIDS/Lighting: NDB

Maintenance Facilities:

Operator:	
Services Available:	No ATC or safety service

Fuel Facilities:

Types Available	No fuel and no maintenance
Storage Volume	
Delivery System	

Based Aircraft:	<u>Types</u>	<u>Number</u>
	None	

Special Features
or Comments:

Table 16

BANGLADESH BIMAN AIRLINES AVIONICS STANDARD PACKAGE

1.	VOR/ILS Navigation System	51 RV-4	Collins
2.	VHF/FM Radio Set	AN/ARC-160	Sylvania
3.	VHF Radio Set	618 M-3	Collins
4.	HF Radio Set	618 T-3	Collins
5.	HF/SSB Radio Set	628 T-1	Collins
6.	UHF Radio Set	AN/ARC-159	Collins
7.	Intercom Set	C-653 /ARC	ARC
8.	Marker Beacon	51 Z4	Collins
9.	ADF (LF)	51 Y-7/DF-206	Collins
10.	ADF (UHF/VHF)	DF 301E	Collins
11.	DME	DME-40	Collins
12.	ATC Transponder	621 A-6A	Collins
13.	Radar (WX)	RDR-1E or I300	Bendix
14.	Gyro Compass	C-9	Sperry
15.	Autopilot	SEP-2 or SEP-6	Smiths
16.	Flight Director	FD-108 or FD-109	Collins
17.	Flight Data & Voice Recorder	Various	Various
18.	AFCS	SPZ-600	Sperry
19.	HSI	331 A-9G	Collins
20.	INS	LTN-72	Litton
21.	Altitude Director Indicator	Various	Various
22.	Radar Altimeter	AN/APN-198	Honeywell
23.	VSI	Various	Various
24.	Ground Proximity Warning System	Various	Various
26.	Crew Address System	346D-18	Collins
27.	TAS Computer	422-18152-914	IDC
28.	Avionics Management System	Various	Various
29.	Heading Repeater	Various	Sperry

Source: DMS Inc., World Avionics Study

TABLE 17 BANGLADESH DEFENSE FORCE AIR WING FLIGHT EQUIPMENT

Name and Number or Aircraft	Type	Made In	Quantity
<u>Attack, Fighter, Reconnaissance Aircraft</u>			
Mikoyan MiG-21 MF	Fighter	USSR	5
Shenyang J-6/FT-6	Attack/ Reconnaissance	China	30
<u>Transport Aircraft</u>			
Antonov An-12 Cub		USSR	4
Antonov An-24		USSR	1
Antonov An-26 Curl T		USSR	3
Douglas DC-6		USA	1
<u>Trainer Aircraft</u>			
Fouga CM.170 Magister		FRANCE	8
Mikoyan MiG-21UM		USSR	2
Shenyang BT-6		China	12
<u>Helicopters</u>			
Aerospatiale SA.316B Alouette III		France	4*
Bell-206L		USA	5
Bell-212		USA	6
Mil Mi-4 Hound		USSR	4
Mil Mi-8		USSR	6

*May not be in service.

TABLE 18 MILITARY TRANSPORT AND CIVILIAN AIRCRAFTS OF BANGLADESH

Name of Aircraft	Number of Aircraft	Passenger Capacity	Freight Capacity (lbs.)	Minimum Runway Requirements (ft.)	Range (miles)	Maximum Speed (mph)
<u>Military Transport Aircrafts</u>						
Antonov An-12 Cub	4	100 Paratroops or 44,092		-	2,237	482
Antonov An-24	1		12,566	-	397	280
Antonov An-26 Curl T	3	40 Troops or	12,125	-	684	280
Douglas DC-6	1	74 Troops or	27,000	-	4,610	356
<u>Bangladesh Biman Aircraft</u>						
Boeing 707	6	189	96,000	8,000	4,235-6,160	535
Fokker F27-600	4	48	14,193	2,310	1,197	302
Fokker F28	2	85	17,000	5,200	1,125	523
MDD DC-10-30	3	380	106,550	5,350	4,000	-

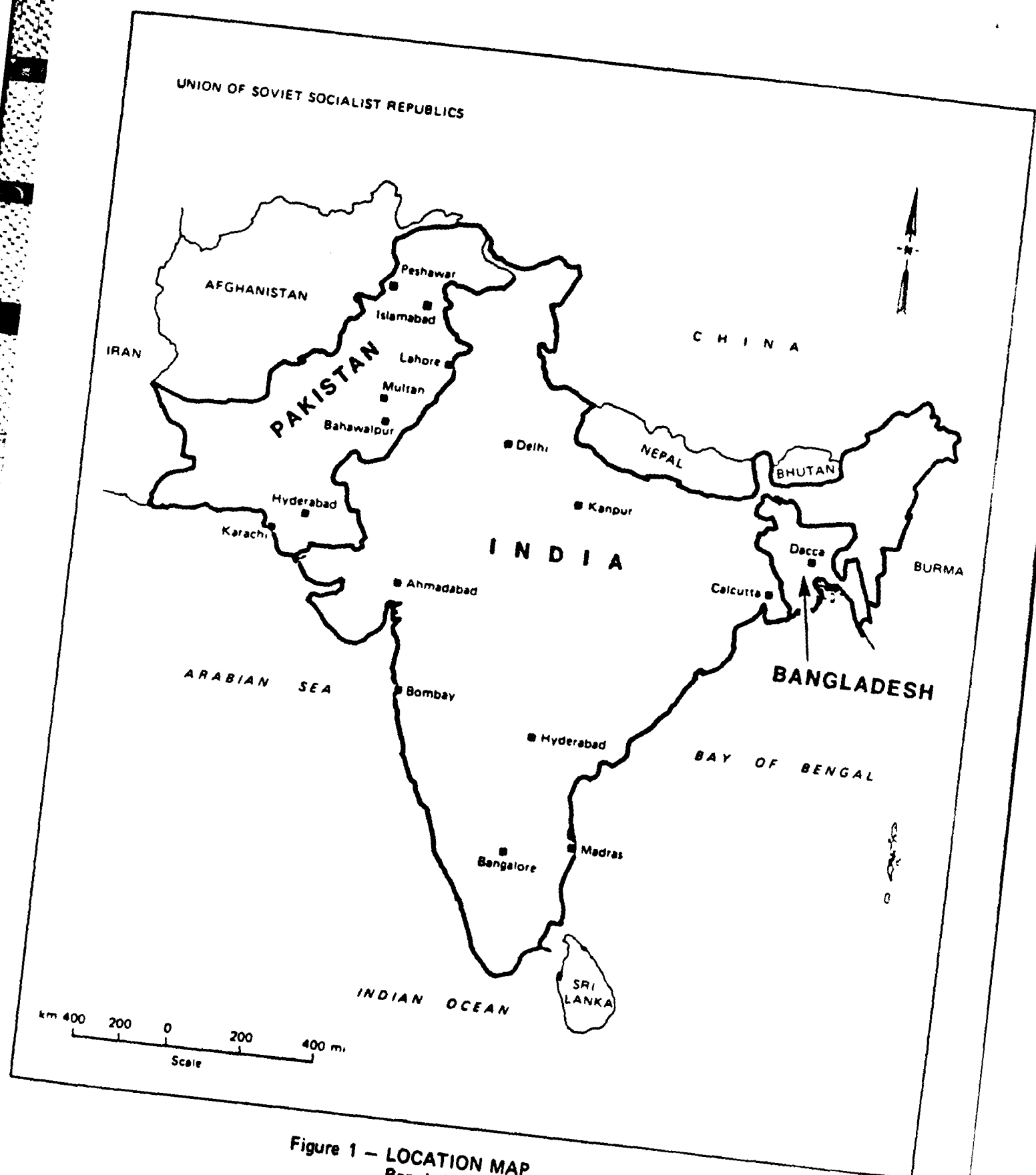


Figure 1 — LOCATION MAP
Bangladesh, India and Pakistan

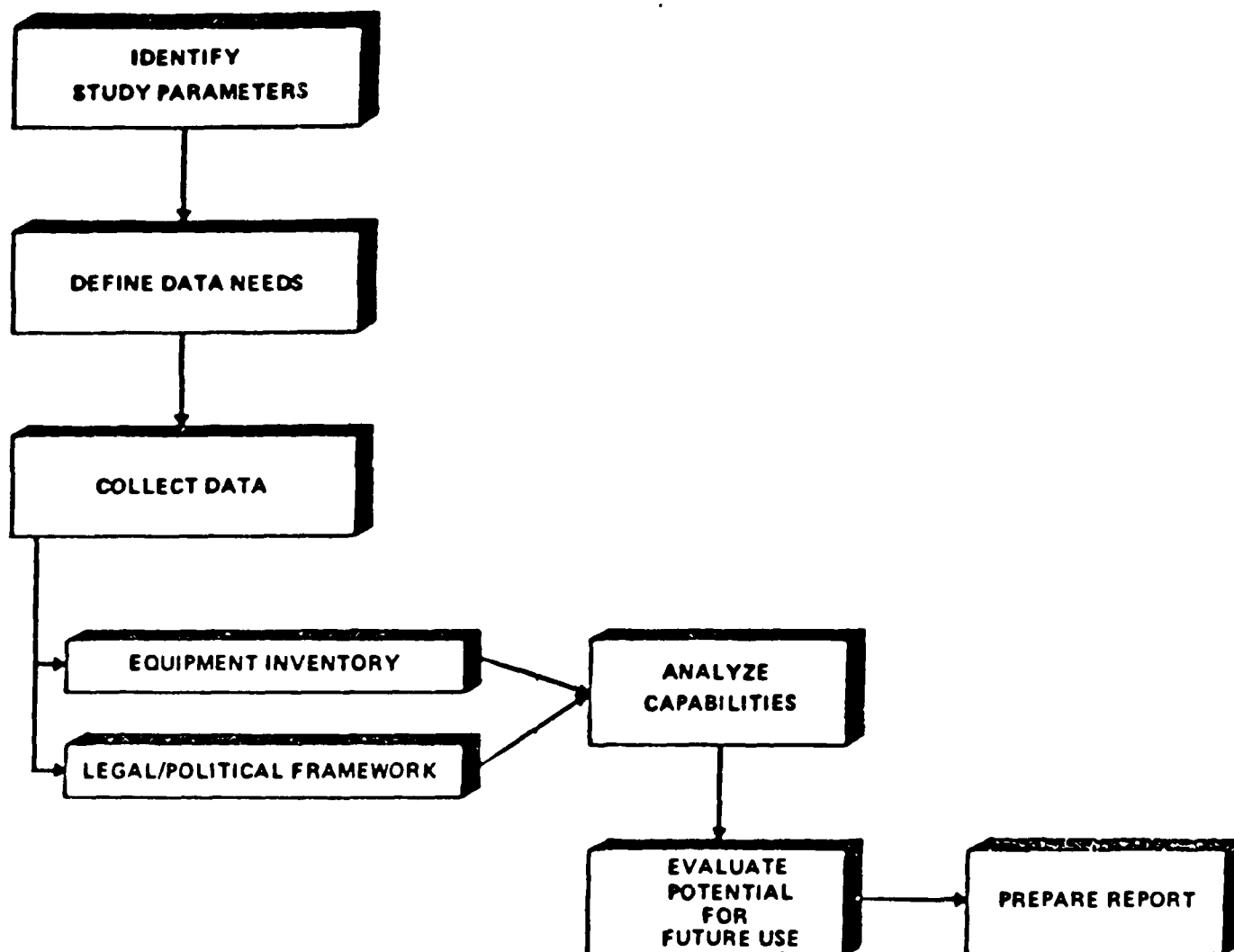
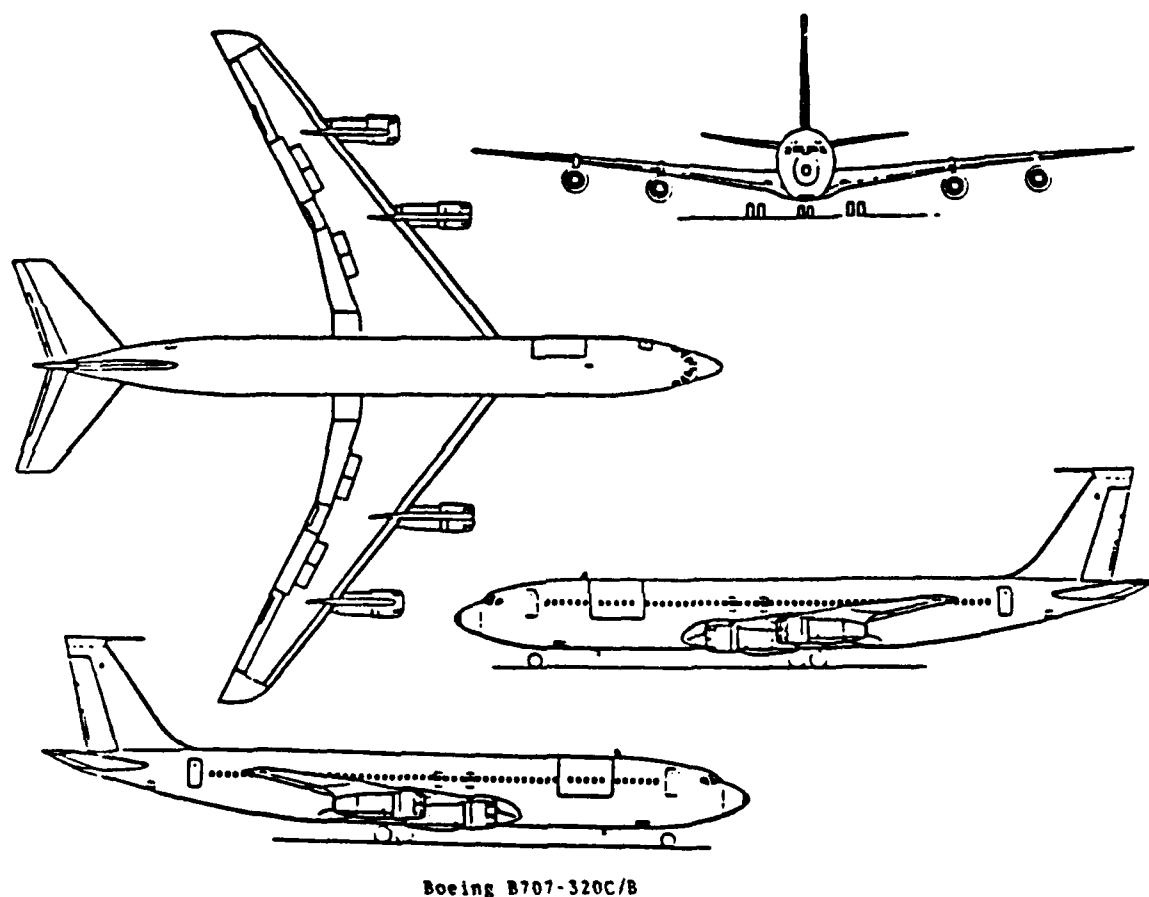
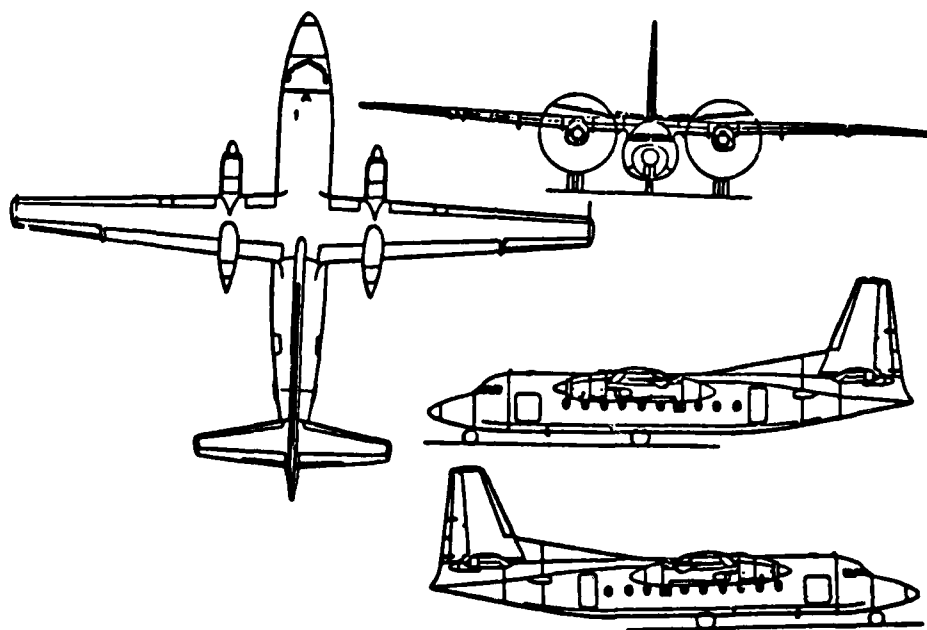


Figure 2. RESEARCH METHODOLOGY



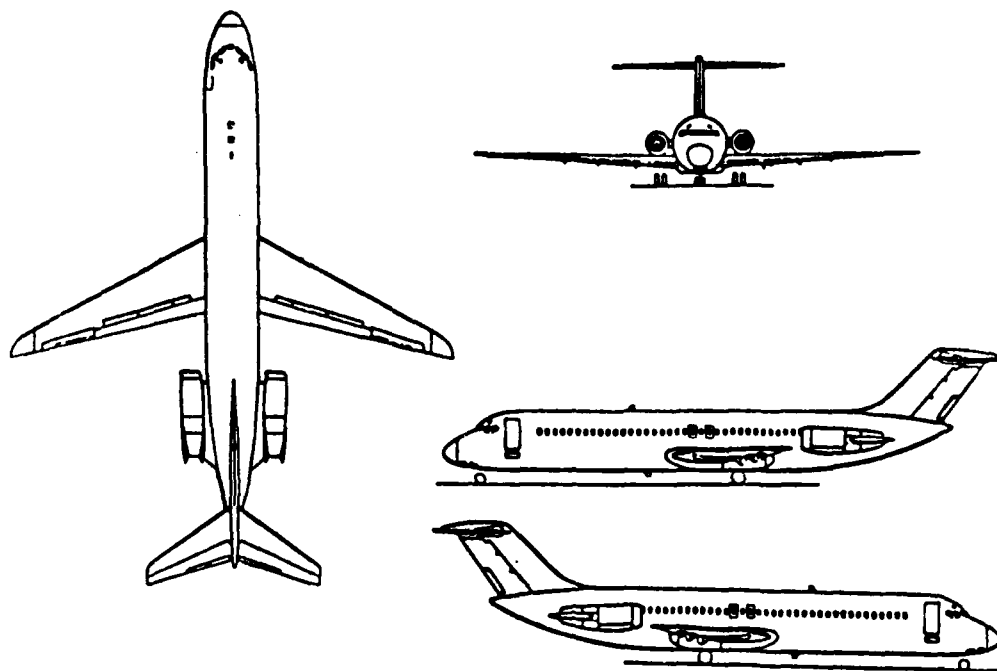
Boeing B707-320C/B

Figure 3. GENERAL AIRCRAFT DATA-BOEING B707-320C/B



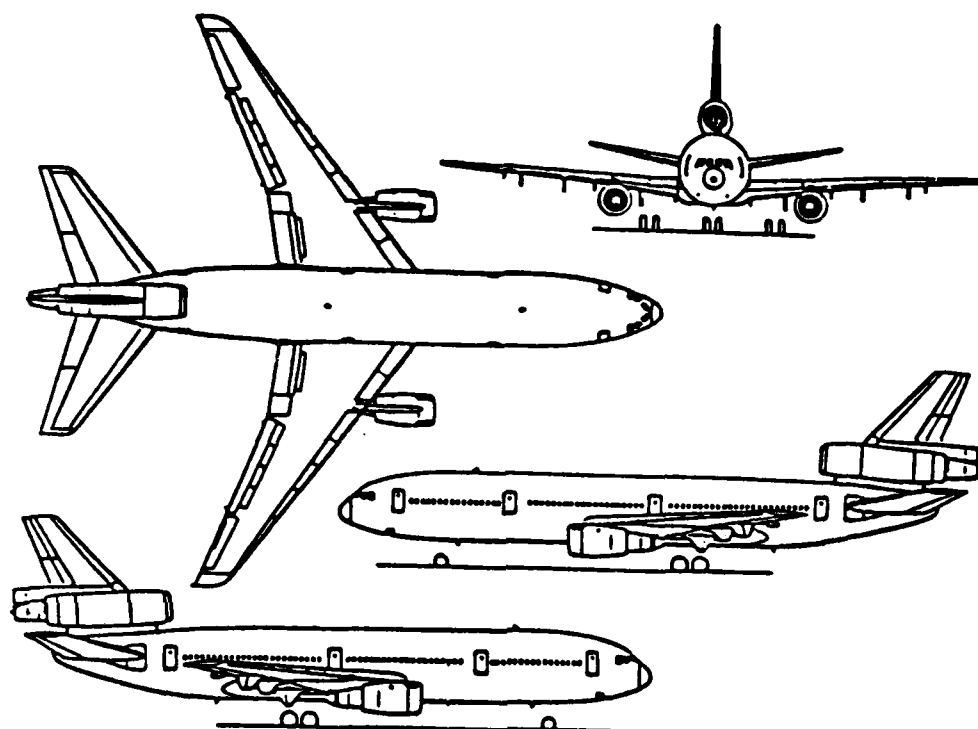
FOKKER F27-600

Figure 4. GENERAL AIRCRAFT DATA—FOKKER F27-600



FOKKER F28-4000

Figure 5. GENERAL AIRCRAFT DATA—FOKKER F28- 4000



DC-10-30

Figure 6. GENERAL AIRCRAFT DATA-DC-10-30

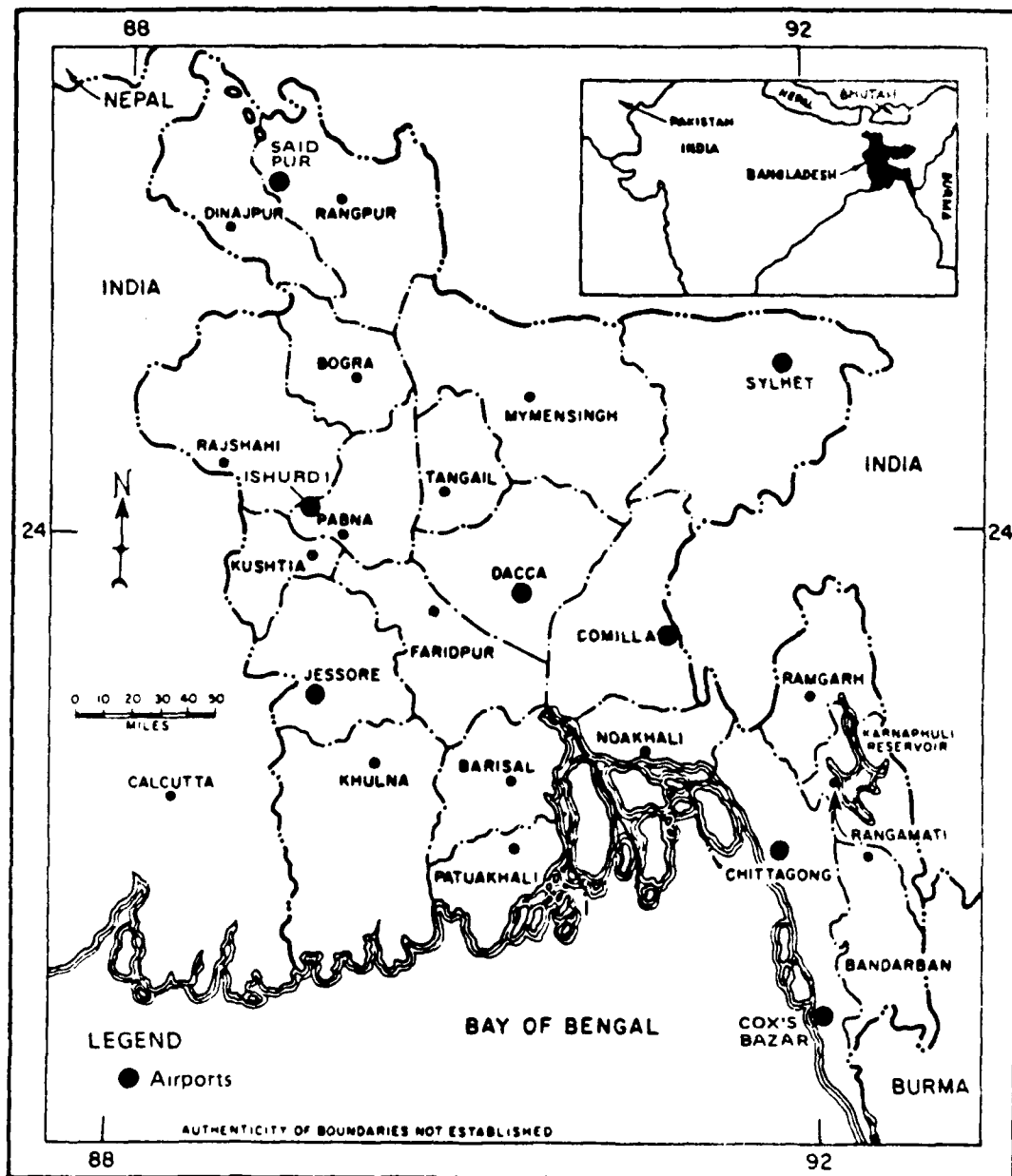
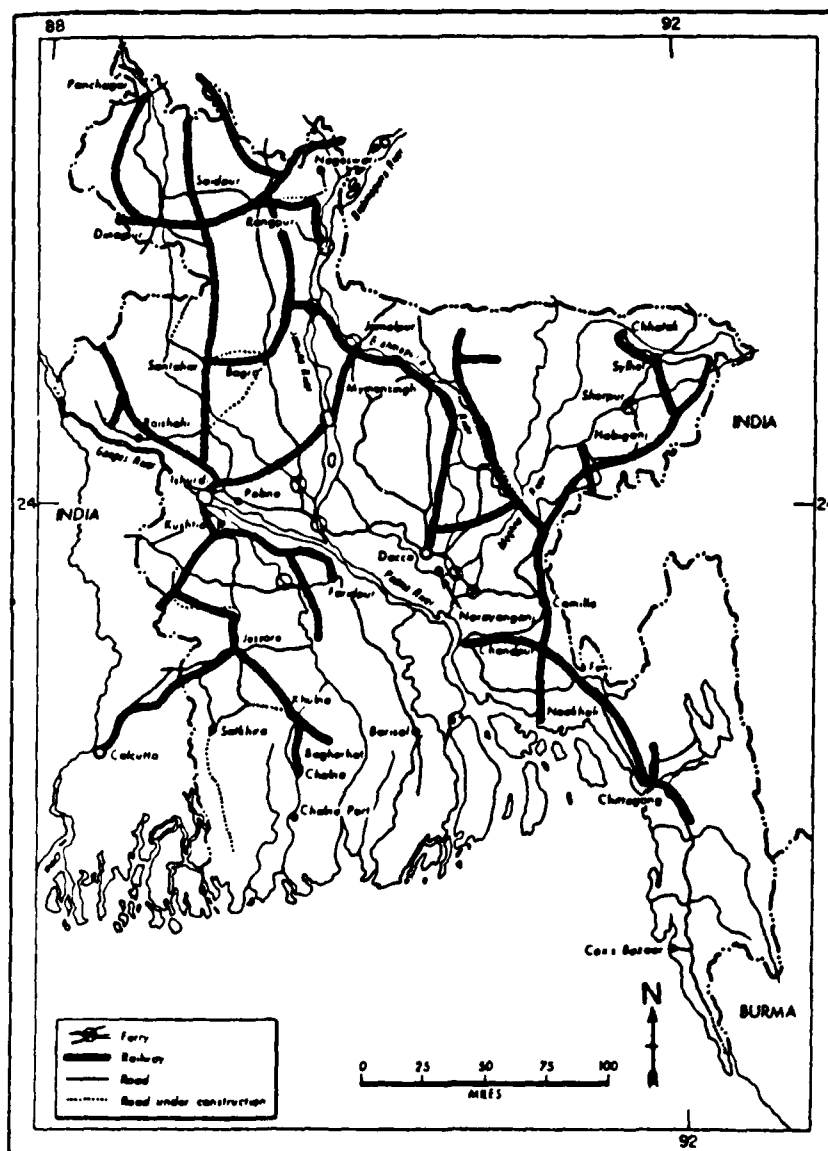


Figure 7. CIVILIAN AIRPORTS – BANGLADESH
BIMAN AIRLINES



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FINANCIAL DATA — SCHEDULED AIRLINES

PART 1 — PROFIT AND LOSS STATEMENT

COUNTRY BANGLADESH

AIRLINE BANGLADESH BIRAN

FISCAL YEAR ENDED

30 JUNE

1981

DESCRIPTION	U.S. CURRENCY				Percentage of total	REPORTING CURRENCY		
	Dollars (Thousands)	Costs per constant 1981		TAKA		TAKA Per constant 1981		
		Performed	Audited			Performed	Audited	
REVENUES	1 Scheduled carrier fares	85 352	62.3	37.5	93.4	1 372 542 492	10.26	6.18
	1.1 Passenger	75 209	58.49	...	84.5	1 238 452 629	11.278	...
	1.2 Excess baggage	2 344	...	...	2.6	38 603 919	...	...
	1.3 Freight, express and diplomatic bags	5 397	27.3	...	6.0	88 876 329	4.49	...
	1.4 Mail	401	64.3	...	0.4	6 607 615	10.59	...
2 Non-scheduled flights	1 512	...	...	1.7	24 900 485	...	...
3 Incidental revenues	4 370	...	...	4.9	71 968 408	...	...
4 TOTAL OPERATING REVENUES	89 234	66.7	48.2	100.0	1 469 409 385	10.99	6.62	
EXPENSES	5 Flight operations (total)	67 368	35.4	21.3	69.1	779 999 670	5.83	3.51
	5.1 Flight crew salaries and expenses	1 227	0.9	0.6	1.3	20 208 837	0.15	0.09
	5.2 Aircraft fuel and oil	40 071	30.0	18.1	41.5	659 837 803	4.93	2.97
	5.3 Flight equipment charges and unrelated taxes	1 061	0.8	0.5	1.1	17 475 253	0.13	0.08
	5.4 Rental of flight equipment	3 289	2.5	1.5	3.4	54 161 099	0.41	0.24
	5.5 Flight crew training (other than scheduled)	313	0.2	0.1	0.3	5 351 510	0.04	0.02
	5.6 Other flight expenses	1 407	1.1	0.6	1.5	23 165 108	0.17	0.10
	6 Maintenance and overhaul	8 399	6.3	3.8	8.7	138 312 871	1.03	0.62
	7 Depreciation and amortization (total)	3 626	2.7	1.6	3.8	59 711 652	0.45	0.27
	7.1 Normal depreciation of flight equipment	1 808	1.4	0.8	1.9	29 779 665	0.22	0.13
	7.2 Normal depreciation of ground property and equipment	1 818	1.4	0.8	1.9	29 931 987	0.22	0.13
	7.3 Extra depreciation (in excess of cost)	-	-	-	-	-	-	-
	7.4 Amortization of development and pre-operating costs	-	-	-	-	-	-	-
	7.5 Flight crew training (other than scheduled)	-	-	-	-	-	-	-
	8 User charges and station expenses (total)	12 289	9.2	5.5	12.7	202 368 867	1.51	0.91
	8.1 Landing and associated airport charges	3 658	2.7	1.6	3.8	60 231 106	0.45	0.27
	8.2 Enroute facility charges	-	-	-	-	-	-	-
	8.3 Station expenses	8 632	6.5	3.9	8.9	142 137 761	1.06	0.64
	9 Passenger services	5 549	4.1	2.5	5.8	91 366 623	0.68	0.41
	10 Ticketing, sales and promotion	5 859	4.4	2.6	6.1	96 481 774	0.72	0.43
	11 General and administrative	4 534	3.4	2.0	4.7	74 656 044	0.56	0.34
	12 Other operating expenses	8 857	6.6	4.0	9.2	145 843 504	1.09	0.66
	13 TOTAL OPERATING EXPENSES	96 481	72.1	43.5	100.0	1 588 741 005	11.88	7.16
OR	14 OPERATING RESULT	-7 247	-5.4	-3.3		-119 331 620	-0.89	-0.54
NON-OPERATING	15 Retirement of property and equipment	-	-	-		-	-	-
	16 Interest	-1 792	-1.3	-0.8		-29 508 012	-0.22	-0.13
	17 Payments from public funds not allocated elsewhere (total)	-	-	-		-	-	-
	17.1 Direct subsidies	-	-	-		-	-	-
	17.2 Other payments	-	-	-		-	-	-
	18 Airframe expenses	-	-	-		-	-	-
	19 Other non-operating items	-201	-0.2	-0.1		-3 310 070	-0.02	-0.01
20 NON-OPERATING ITEMS (net)	-1 993	-1.5	-0.9		-32 818 082	-0.25	-0.15	
NET PROFIT OR LOSS	21 PROFIT OR LOSS (-) BEFORE INCOME TAXES	-9 240	-6.9	-4.2		-152 149 702	-1.14	-0.69
	22 Income taxes	-	-	-		-	-	-
	23 PROFIT OR LOSS (-) AFTER INCOME TAXES	-9 240	-6.9	-4.2		-152 149 702	-1.14	-0.69

Rate of exchange: U.S. \$ 0.060728 = 1 TAKA

(U. S. MONTHLY BULLETIN, AUG 81, 12 MONTH AVERAGE)

NOTES

Rate of exchange: U.S. 0.060728 = 1 Taka

(U. N. MONTHLY BULLETIN, AUG 81, 12 MONTH AVERAGE)

NOTES

COUNTRY BANGLADESH
AIRLINE BANGLADESH BIHAN

FINANCIAL DATA - SCHEDULED AIRLINES

FISCAL YEAR ENDED 1981

PART 2 - BALANCE SHEET

ASSETS	U.S. Dollars (Thousands)	TAKA	LIABILITIES	U.S. Dollars (Thousands)	TAKA
1 Current assets	34 028	560 335 667	12 Current liabilities (other than reported in item 13)	19 014	313 093 779
2 Equipment purchase funds	-	-	13 Unearned transportation revenues	5 045	81 077 811
3 Other stated funds	-	-	14 Deferred credits	1 078	17 750 422
4 Flight equipment before depreciation	26 056	429 661 725	16 Operating reserves	5 061	50 599 758
4.1 Less: Reserve for depreciation	-9 179	-154 462 557	18 Self insurance reserves	-	-
4.2 Flight equipment after depreciation	16 877	274 619 168	19 Other reserves	-	-
5 Ground property and equipment before depreciation	13 626	224 383 924	20 Advances from affiliated companies	-	-
5.1 Less: Reserve for depreciation	-5 769	-94 994 844	21 Other liabilities	12 114	199 483 390
5.2 Ground prop. & equip. after depreciation	7 856	129 389 080	22 Long term debt	23 488	386 772 427
6 Land	332	5 475 464	23 Capital assets	1 549	25 500 000
7 Investments in affiliated companies	538	5 071 507	24 Capital surplus	1 229	70 731 225
8 Deferred charges (total)	-	-	25 Net balance of unappropriated retained earnings (Identical to item 6 of Part 3 below: Statement of Retained Earnings)	-7 047	-116 039 130
8.1 Development and pre-operating costs	-	-			
8.2 Other deferred charges	-	-			
9 Intangible assets	-	-			
10 Other assets	327	5 384 774			
11 TOTAL ASSETS	59 530	980 273 660	24 TOTAL LIABILITIES	59 530	980 273 660

PART 3 - STATEMENT OF RETAINED EARNINGS

DESCRIPTION	U.S. Dollars (Thousands)	TAKA
1 Net balance of unappropriated retained earnings for previous years, as shown in item 6 of last year's statement of retained earnings	1 773	29 188 863
2 Adjustments to previous year's retained earnings (total)	420	6 921 709
2.1 Transfer to reserves	-	-
2.2 Amount sold to others, dividends, etc.	-	-
2.3 Other	420	6 921 709
2.4 Other	-	-
3 Profit or loss (or other income item) for this year (as shown in item 23 of Part 1, Profit and Loss Statement)	-9 240	-152 149 702
4 Appropriations (total)	-	-
4.1	-	-
4.2	-	-
4.3	-	-
5 Dividends	-	-
6 NET BALANCE OF UNAPPROPRIATED RETAINED EARNINGS FOR THE CURRENT AND PREVIOUS YEARS, as shown in item 23 of Part 2 above	-7 047	-116 039 130

REVENUE TRAFFIC (FORM A-1)

DESCRIPTION	SCHEDULED SERVICES				NON SCHEDULED FLIGHTS	TOTAL OPERATIONS
	Passenger	Freight	Mail	Total		
Tonne-kilometers performed (Thousands)	113 3000	19 805	624	133 729	...	133 729
Tonne-kilometers available (Thousands)	...	...	...	222 000	...	222 000

Rate of exchange U.S. 0.060728 = 1 TAKA

(U. N. MONTHLY BULLETIN, AUG 81, 12 MONTH AVERAGE)

NOTES:

AIRPORTS-BANGLADESH

Airport Name/Code: Patenga (CGP)

Location: (City) (Geo. Coordinates)
Chittagong N 2215.5 / E 09149.5

Temperature Data: Field Elevation: 12 ft. MSL
Average Daily - Maximum 85°F
- Minimum 69°F

Runways: Orientation - 05/23 14/32
Length/Width - 10,000 x 150 5,550 x 150
Surface Type/Strength - Concrete/Bitumen Asphalt (Bitumen)

NAVAIDS/Lighting: ATC Control Tower; VOR; NDB; Portable lights; runway lights; VASI (visual approach slope indicator system)

Maintenance Facilities:

Operator -
Services Available - no known maintenance facilities and safety service available

Fuel Facilities:

Types Available - Grade 100 gasoline low lead and Jet A-1
Storage Volume - Unknown
Delivery System - Unknown

Based Aircraft: Types Number
None

Special Features or Comments:

AIRPORTS-BANGLADESH

Airport Name/Code: CXB

Location: (City) (Geo. Coordinates)
Cox's Bazaar N 2127.0 / E 09158.1

Temperature Data: N/A Field Elevation: 15 ft. MSL

Runways: Orientation - 07/35
Length/Width - 6,000 x 150
Surface Type/Strength - Asphalt & concrete

NAVAIDS/Lighting: Emergency lighting only open by NOTAM; ATC Tower; NDB

Maintenance Facilities: N/A

Operator -
Services Available -

Fuel Facilities: N/A

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	None	

Special Features or Comments:

AIRPORTS—BANGLADESH

Airport Name/Code: Tezgaon (DAC)

Location:	(City)	(Geo. Coordinates)
	Dacca	N 2346.8 / E 09023.2

Temperature Data: N/A Field Elevation: 24 ft. MSL

Runways: Orientation - 17/35
Length/Width - 9,000 x 150
Surface Type/Strength - Concrete

NAVAIDS/Lighting: NDB; ATC Control Tower; ground control approach lights; high intensity runway lights (HIRL); VASI

Maintenance Facilities:

Operator -
Services Available - Light maintenance available

Fuel Facilities:

Types Available - Grade 100 low lead (limited quantity), Jet A-1, JP-4
(military specification)
Storage Volume - Unknown
Delivery System - Unknown

Based Aircraft: Types Number

All aircraft listed in Section 3 are based at this airport.

Special Features or Comments: Not allowed as an alternate airport, no night stops

AIRPORTS-BANGLADESH

Airport Name/Code: IRD

Location:	(City)	(Geo. Coordinates)
	Ishurdi	N 2409.2 / E 08903.2

Temperature Data: N/A

Field Elevation: 46 ft. MSL

Runways:	Orientation -	15/33
	Length/Width -	4,700 x 75
	Surface Type/Strength -	Concrete

NAVAIDS/Lighting: VOR; NDB; ATC Control Tower; lighting; flares

Maintenance Facilities: N/A

Operator -
Services Available -

Fuel Facilities:

Types Available - Unknown type available
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	None	

Special Features or Comments:

AIRPORTS—BANGLADESH

Airport Name/Code: JSR

Location:	(City)	(Geo. Coordinates)
	Jessore	N 2311.0 / E 08909.9

Temperature Data:	N/A	Field Elevation:	20 ft. MSL
-------------------	-----	------------------	------------

Runways:	Orientation -	16/34
	Length/Width -	8,000 x 150
	Surface Type/Strength -	Asphalt & concrete

NAVAIDS/Lighting: Runway lights; VASI; ATC Tower; NDB

Maintenance Facilities: N/A

Operator -
Services Available -

Fuel Facilities: N/A

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	None	

Special Features or Comments:

AIRPORTS-BANGLADESH

Airport Name/Code: SPD

Location:	(City)	(Geo. Coordinates)
	Saidpur	N 2545.8 / E 08854.6

Temperature Data:	N/A	Field Elevation:	125 ft. MSL
-------------------	-----	------------------	-------------

Runways:	Orientation -	17/35
	Length/Width -	5,000 x 100
	Surface Type/Strength -	Asphalt

NAVAIDS/Lighting: Runway lights; VASI; VOR; NDB; ATC Tower

Maintenance Facilities: N/A

Operator -
Services Available -

Fuel Facilities: N/A

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	None	

Special Features or Comments:

AIRPORTS-BANGLADESH

Airport Name/Code: ZHM

Location:	(City)	(Geo. Coordinates)
	Shamshernagar	N 2425.0 / E 09153.0

Temperature Data:	N/A	Field Elevation:	56 ft. MSL
-------------------	-----	------------------	------------

Runways:	Orientation -	17/35
	Length/Width -	5,000 x 75
	Surface Type/Strength -	Concrete

NAVAIDS/Lighting: N/A

Maintenance Facilities: N/A

Operator -
Services Available -

Fuel Facilities: N/A

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	None	

Special Features or Comments:

AIRPORTS-BANGLADESH

Airport Name/Code: ZYL

Location: (City) (Geo. Coordinates)
Sylhet Osmani N 2457.5 / E 09152.5

Temperature Data: N/A Field Elevation: 50 ft. MSL

Runways: Orientation - 11/29
Length/Width - 5,600 x 100
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: Runway lights; VASI; ATC Tower; VOR; NDB

Maintenance Facilities: N/A

Operator -
Services Available -

Fuel Facilities:

Types Available - Unknown type available
Storage Volume -
Delivery System -

Based Aircraft: Types Number
None

Special Features or Comments:

AIRPORTS-BANGLADESH

Airport Name/Code: TKR

Location: (City) (Geo. Coordinates)
Thakurgaon N 2600.0 / E 08826.0

Temperature Data: N/A Field Elevation: 176 ft. MSL

Runways: Orientation - 09/27
Length/Width - 5,000 x 75
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: N/A

Maintenance Facilities: N/A

Operator -
Services Available -

Fuel Facilities: N/A

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	None	

Special Features or Comments:

**Civil Airlines/Air Services in Bangladesh
India and Pakistan**

Prepared for
**Defense Intelligence Agency
Washington, D.C.**

Contract No: MDA 908-84-C-0834

January, 1985



DISCLAIMER STATEMENT

"The views, opinions, and findings contained in this report are those of the author(s) and should not be construed as an official Department of Defense position, policy, or decision, unless so designated by other official documentation."

**CIVIL AIRLINES/AIR SERVICES
IN BANGLADESH, INDIA AND PAKISTAN**

**Volume III - India
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1.0 SUMMARY

The primary objectives of the study are to inventory the civilian airlines and air services of India, to evaluate their role in wars and national emergencies, and to assess the potential use in similar situations in the future.

The project team has collected data on the capacity and capabilities of Air India, Indian Airlines, and their support services, examined their role in past national emergencies, reviewed their operating and legal framework and evaluated their potential for use during future emergencies. Only open data sources have been used in the study. The information sources have included interviews with former airline employees, review of historic airline and geopolitical local data, language newspaper coverage around major national emergencies and the knowledge of the project staff team regarding the operating efficiencies of Indian civil airlines/air services and a review of the physical environment and the political system which influences the utilization of civilian airlines during emergencies.

The study established that civilian aircraft have been used in the past for military purposes and they have augmented the military's capabilities for troop and equipment movement. The Indian civil airline is a Government controlled operation. As such, the legal and political environment is not a constraint in its use during national or war emergencies. Before using civilian aircraft, Indian Government evaluates other options such as the use of land transportation systems including railways which have also been extensively used for military purposes during the past war emergencies.

Most of the Indian civil airline flight equipment is comparatively new and the older aircraft are progressively

being replaced with more efficient aircraft. To date, the Government of India has made available the necessary financial resources to meet these fleet expansions to the airlines. Indian civil airlines offer good maintenance and overhaul capabilities for the existing fleet and their record of grounding of aircraft due to mechanical break down has been minimal. The major Indian airports offer adequate communication, cargo handling, fuel availability, and maintenance facilities for general emergency needs whereas the minor airports have limited equipment and facilities which make their use restricted. At their training facilities, Indian Airlines and Air India not only train their own personnel but also train personnel from the Indian Air Force and personnel from other airlines.

The Indian military's transportation capabilities appear to be restricted and Indian civil airlines and air services are capable of augmenting military's troop and light equipment carrying capabilities if called upon during wars or other national emergencies.

2.0 INTRODUCTION

Woodward-Clyde Consultants, under contract No. MDA 908-84-C-0834 with the Defense Intelligence Agency (DIA) has performed a study entitled Civil Airlines/Air Services in Bangladesh, India and Pakistan. The overall purpose of this study is to examine and discuss the capability and capacity of the civil airlines and civil air services of these countries and to evaluate their potential to support respective military forces in the event of conflicts or other national or defense emergencies, and based on their characteristics, evaluate the past employment of the civil airlines/air services during such occurrences. Specific objectives of the study as outlined in the contract and as discussed with the DIA in a meeting on March 29, 1984 in Washington, D.C. include:

- (a) Inventory of each civil airline's flight equipment, and its capacity for normal operations.
- (b) Description of civilian airports, personnel, communication systems, and maintenance facilities.
- (c) Organizational, legal and operational framework of the airline and its financial resources.
- (d) Previous history of airline usage during national emergencies.
- (e) Review of the capabilities of military aircraft and military airports, and
- (f) Evaluation of the capabilities and the potential of the civil airline to serve the needs of the military, if called upon during national emergencies.

The report is divided in four volumes. Volume I is a summary report which provides an overview, regional setting, a brief description of the civil airline operations, a comprehensive evaluation and their potential use during national emergencies. Individual country volumes II, III, and IV for Bangladesh, India and Pakistan respectively, present factual and available data including an inventory of aircraft, list of airports, staff categories and their training requirements, communication systems and maintenance facilities and a brief assessment of the potential use of the civil airlines during military emergencies. Also included is a brief description of military aircraft and military airports and a comparison of military transport aircraft with the civilian aircraft and how the civilian airlines supplement military's troop and equipment carrying capacity. For the purpose of this study, civil airlines are considered those publicly owned and operated airlines normally engaged in the business of passengers and cargo transportation in the country. The location of Bangladesh, India and Pakistan is presented on Figure 1.

3.0 RESEARCH METHODOLOGY

The research methodology utilized in the study is presented on Figure 2 and consists of the following five steps:

- i) Define Study Parameters
- ii) Define Data Needs
- iii) Collect Data
- iv) Analyze Capabilities and Past Use
- v) Evaluate Potential for Future Use.

The activities in each step are briefly described below:

i) Identify Study Parameters

The scope of work as defined in the solicitations and in the contract was used as a base document for identifying the study parameters. Discussion with the DIA on the objectives and scope of work supplemented the understanding of this task. The project team's knowledge of the use of civil aviation in Bangladesh, India and Pakistan during normal and emergency conditions also aided in identifying the study parameters.

ii) Define Data Needs

The data needs identified in this task included (a) current information on civil aircraft and airports, personnel categories, ground and in-flight communication systems, and the location and capabilities of maintenance facilities; (b) historical data on the past use of civil airlines during national emergencies; (c) details of future acquisition plans; and (d) data on military aircraft and airports. All this data was used in the evaluation and assessment of civil aviation's

ability to support each country's military forces during national emergencies. Completeness and accuracy of data is considered to be of prime importance in Task (ii).

iii) Collect Data

Based on an understanding of Tasks (i) and (ii), the project team has identified a number of primary data sources for data collection. These sources have included a review of civil aviation publications and Indian newspapers, around the dates of national emergencies, a study of civil aviation data and personal interviews with people knowledgeable in civil aviation matters. Table 1 presents a list of libraries which the members of the project team have used for data collection. Table 2 is a list of local newspapers which have been studied to review any news coverage of the role of civil aviation during national emergencies. The newspaper studies particularly covered periods around the dates of major border conflicts and wars either between India and Pakistan in 1947-1948, in 1965 and in 1971 and between India and China in 1962. The collected data was supplemented by personal interviews by the members of the project team with people who are knowledgeable in the Indian civil aviation operation and practices.

iv) Analyze Capabilities

An analysis of the capabilities of Indian civil aviation as presented in the report is based on (a) available data as collected in Task (iii), (b) the knowledge of the project team, and (c) interviews with people who have knowledge of the capabilities and the operating efficiencies of Indian civil aviation.

The review of local newspapers have revealed very little direct information on the use of civil aviation for military purposes during India's wars with Pakistan and China. During the wars of 1962, 1965, and 1971, civil aviation, including foreign airline operations, were more or less completely stopped to avoid aircraft being caught in aerial warfare, due to restrictions on fuel and use of navigational aids at the airports. During natural emergencies, Indian Air Force aircraft and helicopters were used to drop relief goods and medical supplies in the affected areas. Local newspapers have generally not covered the use of civilian aircraft for mass troop or equipment and artillery movements. Typically, such movements are considered sensitive from a military strategy point of view and discussion in public newspapers is discouraged. During the analysis in Task IV, a number of data gaps were identified, particularly in the areas of staff training capabilities, communication networks, military airports and the past use of civil aircraft for military purposes. These data gaps are supplemented either by personal interviews with former airline employees and retired Indian military personnel or by the experience of the project team in the operation of the Indian civil airlines and air services.

v) Evaluate Potential for Future Use

The data analysis in Task (iv) formed the basis for analyzing the future use of airline for which several scenarios and purposes are evaluated. A further description of the assessment and the potential use of airlines for military purposes, is presented in Sections 7.0 and 8.0, respectively.

4.0 LIMITATIONS OF THE STUDY

The contract scope of work has required the use of open source material with no field research in India. The project team has found limited publicly available information in the United States in the areas of personnel training, communication systems, maintenance facilities, future outlook of Indian civil aviation and civil and military interface during national emergencies. Major gaps exist with respect to data on personnel morale and efficiency, political affiliations, age, distribution, communication systems, maintenance effectivity; details of the past use of civil airlines; details of future outlook of the airlines; and decision making profiles of the Board of Directors and the operational management of the airlines. Traditionally, information related to the activities of the Government and the semi-Government departments in India stays buried in inter-departmental memos and Government files. On rare occasions, evaluations or analyses relevant to this study are published in journals. The very few articles that have been published by the Indian Institute of Management are generic in nature and do not provide specific insights. Specific questions from outsiders about the capabilities and capacities of civil aviation generally arouse suspicion in the minds of Indian officials and simple acts like taking a picture of an airport are not permitted. The project team was able to fill some of the data gaps by utilizing the services of the consultants with active local connections in the Indian civil aviation industry. However, field research will be needed to augment the data base to a satisfactory level.

5.0 CIVIL AIRLINES/AIR SERVICES IN INDIA

5.1 GENERAL OVERVIEW

5.1.1 Origin and History

According to Menon, 1978, the first flight in India did not occur until the end of the nineteenth century although during the pre-independence period and within historic time, Indian epics Ramayana (300 B.C.) and Mahabharata (400 A.D.) and poetical works Suenas Raghuvamsa (500 A.D.) and Yuktikalpataru (1100 A.D.) contain many descriptions of flight vehicles and a number of ancient sculptures and paintings indicate the longing of Indian people to accomplish the art of flying. In February 1911, in pursuance of the arrangements made by the Posts and Telegraphs Department of the Government of India, an aircraft labeled as First Aerial Post United Provinces Exhibition, Allahabad, 1911, carried a bag of messages in a Humber biplane from the Allahabad to Naini Junction, located six miles away in thirteen minutes. Although this flight aroused interest, India lacked finances and appropriate industrial and technological facilities for research and as a result of that no other aeronautical event of significance occurred until after World War I.

World War I proved the importance of air power and caused a shift in focus from naval to air power. Accordingly, in 1924 the British Government linked London and Karachi, by Imperial Airways, the aviation arm of British Government. This service was later extended to Delhi, the seat of Indian Government. As India still lacked technical and financial resources to operate a domestic service, and the nationalistic feeling were high to allowing foreigners to fly within the country, charter arrangements were made between the Indian Government and the Imperial Airways for a domestic service on the condition that

the Imperial Airways will retain complete technical and operational control. This arrangement lasted for about two years. During the period 1933-38, the Indian airline industry made steady progress but high fuel costs, shortage of trained personnel and high travel cost made air travel out of reach but for a tiny minority of people and the airline experienced inordinate operational and financial difficulties.

The outbreak of World War II adversely affected the civil aviation in India and its resources were diverted to the needs of the war. During this time, the air mail and passenger traffic were drastically curtailed and the civil aviation served the needs of the defense department and provided services such as carriage of military freight and personnel, delivery of priority mail of defense importance and air surveys. These assignments have included the survey of the South Arabian route for Royal Air Force (RAF), the shipment of supplies to Iraq, the transport of civilian refugees from Burma and the overhaul and maintenance of RAF equipment at civilian facilities. Also, the war created unprecedented opportunities for expansion and diversification of Indian airlines. These included the construction of new airports, improved radio communications, training a number of Indian personnel and improved efficiency and performance.

In 1946, India created its Air Transport Licensing Board as an autonomous body to examine and license air transport services, monitor its performance and revoke or attach conditions to a license, if necessary. This board has since been dissolved. The Board granted license to fly to a large number of local air service companies. Most of these companies were deficient in organization, equipment, training and operational standards and many of the new routes lacked traffic potential and therefore proved to be economically disastrous.

Due to excess capacity, fares were undercut and many airlines faced bankruptcy and only a few companies survived after the war.

The independence of Indian subcontinent as India and Pakistan in 1947 created new problems and placed extra strain on the already battered and confused system of Indian civil aviation. The new Government of India recognized the need for the state to play a progressively active role in the development of industries. A number of semi-autonomous public corporations were created to ensure the maximum use of all available resources and facilities. Air transport, both domestic and international, was in a critical formative phase and in need of capital, technical know-how and management. Foreseeing the need to conserve and to make best use of country's meager resources and realizing the international travel potential, Air-India was established as Air India International in March 1948 to succeed Tata Airlines which was founded in 1932 by Indian industrialist J.R.D. Tata. Capital for the newly formed airline was provided by Tata (51%) and the Government of India (49%). By 1952 the condition of all the airlines established in India during the post war period had deteriorated to such an extent that the Government nationalized the Indian civil aviation industry in 1953. The nationalization act created two corporations, namely Air India (International) and Indian Airlines Corporation, the former for long distance international travel and country's flag carrier and the later for domestic air travel and services to neighboring countries.

Landmark events of Air India and Indian Airlines are presented in Tables 3 and 4.

5.1.2 Operating Environment

Since its inception in 1953, Air India has grown to be a major airline serving five continents and has 49 online and 86 offline sales offices all over the world. Air India is self sufficient in engineering and operation facilities and it trains its own staff in all aspects of airline operations. Its engineering base at Bombay is capable of maintaining and overhauling its entire fleet of Boeings and Airbuses. After suffering operating losses of \$20 million in 1980, it has attained profitability in 1981 and has substantially increased revenues and performance. During 1982-83, Air India's capacity has increased 8.6% and it has carried a 6.5% higher passenger load.

The airline obtains major supply of its fuel through Government owned and nationalized oil refineries as well as from Gulf nations. While it has to pay prevailing higher price abroad for its fuel, a plea to provide some relief in price within the country by dropping sales tax has not been heeded by the Indian Government. This no response continues to remain a source of dispute between the airline and the Government. Air India also faces a brain drain of its trained engineers to the Gulf States where salaries are higher. As a result of shortage of trained staff, the Air India's engine service facilities at Bombay sometimes operate under capacity.

Indian Airlines, although performs a vital social and economic function but due to Air India's pre-eminence, suffers somewhat in its image in India. In the last decade it has acquired its fleet to a point where it is the largest air carrier in Asia. By using more air buses in its fleet, its capacity has exceeded demand with an average load factor of 65 percent. The Indian Airline has on its fleet Boeing 737's, Airbuses, Fokker F27s and Indian built HS 748s. Although in

recent years, Indian Airline has succeeded in obtaining funds for aircraft purchases from the Government of India, funding for other purchases such as fully automated data processing systems have not been made available by the Government.

The operational problems of Indian Airlines include below ICAO standard navigational facilities at most of the local airports in India. All of the airports east of Calcutta generally remain closed to the airline operations during the night and at Leh, and Port Blair in the Andaman Island operations after noon are impossible because of high cross winds. The monsoon season presents problems for a few weeks on the country's west coast particularly at Bombay. Cost wise the unionized nature of the airline causes a rigid staffing structures and high overhead cost makes small capacity aircraft (HS748s and F27s) hard to operate economically.

5.1.3 Legal Framework

Menon (1978) in his article entitled "Government Control of the Air Transport System in India", describes the legal framework of Indian civil aviation.

Under the provisions of Indian Constitution, Article 246, the Indian Parliament has full and exclusive power to make laws with respect to any of the matters concerning "airways, aircraft and air navigation, provision of aerodromes; regulation and organization of air traffic and aerodromes, provision for aeronautical education and training and regulation of such education and training provided by States and other agencies and carriage of passenger and goods by air". There does not exist a federal-provincial problem as to jurisdiction for exercising authority in civil aviation matters in India. Further, the Constitution of India takes a

comprehensive view of the activities of the State, and in accordance with the Directive Principles of State Policy, the State directs its policy so that:

the ownership and control of the material resources of the community are so distributed as best to subserve the common good;

and

the operation of the economic system does not result in the concentration of wealth and means of production to the common detriment.

Although the Directive Principles are not enforceable by any court of law, nevertheless they are fundamental in the governance of the country and the States apply these principles in making laws.

The primary reason for the Government control of air transport is that of its quasi-public utility characteristics. The two generally accepted features of a public utility are (1) economic necessity or indispensable service that requires public regulations, ownership or operation, and that (2) the service has monopolistic characteristics. The civil aviation is considered a necessity to the society as such that it is a service which affects time and place utility. It has become the very life-breath of modern industrialized nations. The Indian Industrial Policy Declaration of April 1956 places the aircraft and air transport under the exclusive responsibility of the State as air transportation renders an indispensable service to the civil and military administration of the country. According to Article 298 of the Indian Constitution, the Government of India can acquire or purchase, grant, sell, dispose of or mortgage property and the State is immune from constitutional limitations and is free to compete with any private business or to create a monopoly in favor of itself

without being called upon to justify its action. Also, in accordance with the provisions of Part XIII of the Indian Constitution, regulation of trade and commerce could also be made in public interest without making undue discrimination and by preserving the equality and equal protection of law. These laws are exercised in "public interest" which include public security, public order and public morality. The Air Corporation Act, 1953, under which the two airline corporations were created takes into account these constitutional provisions.

One of the reasons for the nationalization of airlines in India was to maintain a strict and close control over airlines in order to ensure civil aviation development in accordance with public interest. This control on civil aviation in India includes Ministerial Control under which the Minister of Transportation and Aviation, on behalf of the Government of India, appoints members and chairman of the board of directors, and the Minister also remains closely associated with day-to-day decision making of the airline corporation. As such, the Government of India has control (1) to undertake any air transport service or other activity which the corporation has power to undertake and, (2) to discontinue or make any change in any schedule air transport service or other activity which it is operating. Legally, in India the use of airlines during emergencies has never been a problem. Under national emergency conditions, the civil aviation comes under essential services and emergency needs takes precedence over all other operations. A description of the use of civil aviation during emergencies is presented in Section 5.7.

5.1.4 Financial Position

As per data contained in the annual report, Air India collects about 70% of its revenue from passenger traffic, 20% from freight and the remaining 10% comes as incidental revenue

(5%), interests (2%), charter (2%) and mail (1%). On the expenditure side, Air India spends close to 36% on aircraft fuel and oil, 15% on wages, 25% as operational expenses and commissions, pays 5% as interest on loans, 4% on purchase of materials and outside repairs, 8% on administration, 5% on depreciation and obsolescence, and 2% on insurance and other expenses. Except for 1980, the Air India has always made a profit and in spite of a slowdown in economy, it is considered by industry analysts as on a sound financial footing. The financial statistics of Air India are shown in Figure 3.

Indian Airlines collects about 85% of its revenue from passenger traffic, 7% from freight, and the remaining 8% comes from charter (3%), mail (3%) and 2% operating revenue. On the expenditure side, Indian Airlines spends about 42% on fuel and oil, 20% on employee wages, 15% operating expenses, 8% on depreciation, 6% on materials and outside repairs, 6% on landing and navigation charges and 3% on insurance. Except during and 1980, Indian Airlines operations has been profitable and the airline is considered on sound financial footing.

Ten years comparative financial statistics of Air India and Indian Airlines are presented in Appendix A and B. Table 5 shows the glossary of the terminology. Being financially strong, both the airlines are in a position to obtain favorable borrowing terms and fuel and performance efficient aircraft from the open market instead of depending on the terms of lending institutions and countries. From a military point of view, if the aging aircraft are replaced by modern and more efficient aircraft, the civil aviation will be in a better position to serve the needs of the military during national emergencies. The financial statistics of Indian Airlines are shown in Figure 4.

5.1.5 Key Personnel

Key personnel of Air India are presented in Table 6. Key personnel of Indian Airlines are presented in Table 7. A noteworthy feature of the key personnel is that Indian Air Force affiliated personnel are represented in both the airlines including the Board of Directors as well as in the operational management.

The compliment of Indian Airlines and Air India Board of Directors indicates that the Indian Air Force Chief of Staff is an ex-officio member of the Board as well as the Director General of Civil Aviation and Chairman of International Airport Authority of India. Secretaries of the Government departments connected with air transportation in any manner also get appointment on the Board.

5.1.6 Subsidiaries

Air India has three subsidiaries: (1) Chefair which operates flight kitchens and provide meal services to Air India and other foreign airlines, (2) the Hotel Corporation of India which runs Centaur Hotels of Bombay, New Delhi and Sri Nagar Kashmir, and (3) Air India Charters, a wholly owned charter company formed to capture most of the ethnic traffic taken away by nonscheduled operators in and through India. The Air India Charters operate between India and UK at competitive rates. It uses a leased 707 aircraft and crew from Air India. Its creation was to provide an offsetting vehicle against cut rate fare wars by competing foreign carriers in and out of India. The airline does not have a separate workforce of any nature and as such feasibility of its participating in a military emergencies is remote.

Vayudoot (Airline) is a subsidiary of Indian Airlines. It was formed in January 1981 to provide feeder service in the

eastern part of India. It is a third level commuter airlines authorized for commercial operation by the Indian Government. It is a support service catering to smaller Indian communities which were deprived of scheduled airline services from the major domestic carrier - Indian Airlines. The Vayudoot operates to 23 stations using two F27 aircraft leased from Indian Airlines. If required, these aircraft could be called upon to perform airlifting of troops/equipment during national emergencies. The type of aircraft which the Vayudoot operates makes its operation possible into forward areas where the use of scheduled larger aircraft may not offer any advantage to the military during emergencies.

According to a recent news item, the Government of India and German aircraft firm Dornier have signed a contract to license production of about 150 Dornier DO 228-200 aircraft in India during the next 10 years. These aircraft will be operated by Vayudoot, Indian Coast Guard, Navy, Air Force, and Indian Civil Aviation Department. Vayudoot will use the aircraft to replace Fokker F-27s and HS748s. The Dornier could carry 19 passengers and fly a stage length of 474 nautical miles. These aircraft will be built at Hindustan Aeronautics and delivery of the first aircraft to Vayudoot is expected in late 1985.

5.2 FLIGHT EQUIPMENT AND FACILITIES

5.2.1 Aircraft

Both airlines, Air India and Indian Airlines have gone through rapid changes of procuring and substituting flight equipment trying to match growing trends of passenger travel and modern technology.

Indian airlines with its current fleet of 35 jets is the largest operator in Asia. In addition they also have 20 propeller aircraft. Indian Airlines fleet is presented on Table 8.

Air India has 13 wide body aircraft and one 707 in its fleet. The latest addition of 3 airbuses to replace its 707s has considerably increased its potential to meet the ever increasing demand for additional capacity. Air India's fleet breakdown is presented in Table 9. Table 10 provides fleet technical data for wide body aircraft.

The following is a brief description of various aircraft in the active fleet of Indian Airlines and Air India.

DESCRIPTION OF INDIAN AIRLINES FLEET

Fokker-F27

Fokkers were built in the Netherlands to serve short hauls or commuter operation. These aircraft were used by Indian Airlines on feeder routes connecting major cities. Typically it can carry 44 passengers. It flies at 25000 feet and it has 2 turbo prop Rolls Royce engines with a thrust of 3000 lbs. It has a wing span of 95 ft. and overall length of 77 ft. It carries a crew of 3 but it can also operate with 2 in the cockpit. A diagram of Fokker is presented in Figure 5.

Hawker Sydley 748 (HS 748)

These were originally built by British Aerospace Industry. They are now manufactured in India by Hindustan Aeronautics Ltd. at Bangalore. Structurally, they are very similar to F27, but have greater endurance and they can operate on surface that takes DC3 aircraft. They could easily be converted from a regular 55 seater passenger version to a military transport

aircraft with 48 paratroopers and 6 tonnes of freight. It has a wing span of 102 feet and an overall length of 67 feet. It carries a crew of two in the cockpit and up to 55 passengers in the passenger cabin. A diagram of HS 748 is presented in Figure 6.

Boeing 737-200

This is a short/medium range twin jet aircraft that can fly from gravel and unpaved runways with same ease as on the paved one. It is fitted with Performance Data Computer System (PDCS) that provides continuous data on engine performance, fuel burn, airspeed and altitude. It is fitted with standard Pratt and Whitney JT8D-15A engines which cuts down fuel consumption by as much as 10%, and it also reduces the noise levels. The aircraft has all readouts in digital display for ease. It is offered in all cargo, all passengers and mixed passengers/cargo versions. Indian Airlines has 1 convertible and 24 passenger version aircraft. It has a total wing span of 93 feet, is 37 feet high and has an overall length of 100 feet. Typically, it carries 120 passengers and 2 cockpit crew. It has a fuel capacity of 5160 U.S. gallons and range capability of 2200 statute miles.

Convertible cargo/Passenger version of Boeing 737 (identification C737 200C) has 86 by 134 inch forward door and a roller system in the floor. It can accept same pallets as used on conventional convertible jets (707, DC8) which allows easy transfer of cargo. It can be converted to all passengers or passenger/cargo version in less than an hour. A diagram of Boeing 737 is shown in Figure 7.

Airbus A300 - B2/B4

Airbus is built for high density short/medium markets, by Airbus Industries of France. It offers savings in fuel and manhours at the same time increases the passenger capacity to

almost double the size of a conventional Boeing-707 aircraft. It is produced in two versions A300 B2 or A300 B4 and both the versions are externally alike. B2 is a short range version and carries a typical load of 269 passengers and baggage to over 1800 miles with full reserve. B4 is a medium range version, has additional fuel tank in its wings and it can carry a full complement of passengers and baggage to 2700 miles. It is powered by Pratt Whitney JT9D-59 or General Electric CF6-50 engine. The airbus carries 29 tonnes of cargo and it can be converted to a mixed passenger/cargo version in a short time.

Typically, the airbuses have a wing span of 147 feet with an overall length of 177 feet and a height of 54 feet. Both Air India and Indian Airlines have airbuses in their fleets. Indian Airlines/Air India Airbuses are fitted with General Electric CF6-50C2 engine with a thrust of 5200 lbs each. For a description of Airbus A300 B, refer to Figures 8 and 9.

DESCRIPTION OF AIR INDIA FLEET

Boeing 747

Boeing 747 is the largest commercial aircraft in operation at present time with a wing span of 195 feet, height of 63 feet, and a length of 231 feet. It can carry 34,900 lbs of cargo, up to 452 passengers with a fuel capacity of 42481 imperial gallons to an optimum range of 6000 statute miles. Air India 747s are powered with JT9D-7 engine with a maximum thrust of 52000 lbs. This aircraft is also available in all cargo, passenger/cargo version. Although Air India does not have any at the present time, a special performance (SP) version of Boeing 747 is also available with a range of operation up to 10,000 statute miles. Air India's route structure as well as military requirements do not favor in terms of any acquisitions of 747 SPs. Figure 10 presents essential data for Boeing 747.

Boeing 707

Boeing 707 is one of the most popular models manufactured by Boeing. This aircraft is responsible for bringing jet age to many airlines of the world. Because of its poor ratio of load factor to fuel burn it has been phased out from most of the major airline's fleet. Until recently, Air India had 5 of these aircraft but the number has been reduced to one. The discarded 707s have been replaced by Airbuses.

The existing Boeing 707 has a wing span of 145 feet overall length of 153 feet, height of 42 feet with fuel capacity of 19864 imperial gallons and a flight range of 5300 statute miles at full capacity. It cruises between 3500 to 45000 feet and has cargo capacity of 14000 lbs. Figure 11 presents a description of Boeing 707.

Air Bus A300 B2/B4

Air India operates three airbuses. For description refer to Indian Airlines fleet and Figures 5, 6, 7, 8 and 9.

5.2.2 Condition and Age of Fleet:

The date of delivery of Air India fleet is presented in Table 9. The age of Indian Air line fleet is presented in Table 22.

5.2.3 Facilities:

A list of fleet equipment is presented in Table 11.

5.3 CIVILIAN AIRPORTS

India has four major international airports which are located at Bombay, Calcutta, Delhi and Madras respectively. Other airports in India can be divided into 4 major categories

depending upon size, passenger operations, facilities and usage which are maximum at category I and barely essential at category IV airports.

Category I includes airports at: Ahmedabad, Amritsar, Guhati, Hyderabad, Lucknow, Nagpur and Trivandrum.

Category II includes airports at: Agartala, Aurangabad, Barapani, Bhuji Bhubaneswar, Jaipur, Imphal, Khajuraho, Mangalore, Panagarh, Patna, Ranchi, Tiruchirappalli, Udaipur and Varanasi.

Category III airports are: Baroda, Belgaum, Bharnagar, Bhopal, Dibrugarh, Gaya, Indore, Madurai, Lakhimpur, Port Blair Rajkot, Raipur and Silchar (Kumbhigram), Chakulia, Kandia, Keshod, Jabalpur, Tirupati, Vijaywada, and Vishakhapatnam.

Category IV airports are: Akola, Bilaspur, Coimbatore, Cooch Behar, Jharsuquda, Kamalpur, Kanpur, Khandwa, Kota, Kulu, Lalitpur, Muzzaffarpur, Porbandar, Satna, Tanjore, Warangal, Jhansi, Kolhapur, Mysore, Sholapur, Vellore, and Mohanbari.

In addition to the above there are several airports owned and operated by state Governments and Ministry of Defense. A listing of military airports with their handling capabilities is presented in Section 5.9.3.

5.3.1 Location

Figures 12 and 13 present route network of Air India and Indian Airlines, respectively.

5.3.2 Equipment and Facilities at Selected Airports

Appendix C contains a complete description of airports at Amritsar, Calcutta, Madras, Trivandrum, Ahmedabad and Varanasi, which represents a cross section of airports in India.

Airports located at Delhi, Calcutta, Bombay and Madras are typically representative of major and airports located at Bhuj, Indore, Jabalpur, Akola, Bhopal and Tirchirapalli are typical examples of minor airports. Facilities which are generally available at these airports are more or less similar to those available at other airports. A list of cargo handling and fleet support equipment generally available at major airports is presented in Table 11.

5.3.3 Major Airport - Delhi

Delhi is one of the largest international airports in India. The location, meteorological data, runway characteristics, equipment and facilities at Delhi Airport are presented in Table 12. It is situated at 28° 34'N longitude and 77°38'E longitude. It is 8 nautical miles southeast of the city. It has 2 runways with a maximum landing distance of 12,000 feet (3658 meters). It has limited apron space and that restricts non-scheduled international flights to daylight hours. Runways have approach limiting, edge, threshold and endlights of high intensity markings. All visual obstructions and other operationally significant obstructions are marked and lighted. All runways are asphalt and have ICAO approved markings of threshold, touchdown, centerline, side stops and designation numbers. Taxiways have centerline and taxi holding areas marked. The airport is administered by the Director General of Civil Aviation. It provides cargo facilities through local operators. A restaurant and basic medical facilities are also available. All grades of fuel are available at the airport. The airport has maintenance facilities. Although there is no overnight accommodation at the airport, the city provides ample hotels up to 5 star ratings. Public transportation and taxis are easily available.

The temperature at the city varies between 5°C in winter months (November through January) to a high of about 43-45°C in summer. Typically there are heat waves and sandstorms in the summer. Present spaces and facilities at Delhi Airport are insufficient to cope up with the increased daily traffic and the expansion programs for both the international and domestic traffic are underway or planned.

Presently, all traffic at Delhi Airport is handled through two terminals; one with separate domestic and international departure sections and the other is used for arrivals. The annual throughput of terminal building is nearly 4 million people, while its real capacity is not more than 3.5 million. A new international wing has already been built with a capacity of 800 passenger an hour, but it has not been made open to public due to institutional delays and other Government priorities. The annual increase in passenger traffic will not suffice the total terminal capacity as the traffic at all Indian airports is increasing at an average rate of 12 percent a year.

5.3.4 Minor Airport - Tiruchirappalli

Tiruchirappalli airport would represent a minor airport of India. The location, meteorological data, runway character, equipment and facilities at the airport are presented in Table 13. The airport is under direct control of the Director General of Civil Aviation through Madras region. It is situated 10°45'51"N latitude and 78°42'58" longitude at a distance of about 3 miles from downtown area. It is operational during all seasons around the year. The airport has minimum required facilities for fire fighting and medical treatments. It does not have any overnight accommodations, and there is no hangar facility for aircraft in transit maintenance. Refueling facilities are restricted and require

three hours prior notification. A tannary close to the airport constitutes flying hazard due to large number of vultures in the area. The temperature varies between 20°C in winter to 38°C in summer months. The airport has a concrete runway of approximately 8000' and an apron area 700' x 210'. The runway has edge, threshold and ground lights of medium intensity. All operationally significant observations are lighted and marked. ICAO standard markings of centerline, threshold, taxi holding position, taxiway centerline and all taxiways are present.

5.3.5 Maintenance and Airport Construction

Since 1972, the International Airport Authority of India is responsible for the maintenance and construction of airports. The Authority provides all services from a pre-feasibility study, through consultancy and master planning, to the entire package deal including a construction force and all materials and equipment. The Authority is capable to take on master plan and airport design in any part of the world, and is competing with well-established European and American organizations in the developing countries. It has completed several airport projects in the neighboring countries. All major expansions at Delhi and Bombay are being performed by the Authority. Generally, the airport expansion depends on funding by the Government while the rate of progress depends on the availability of construction materials which sometimes are in short supply. Seasonal fluctuations also play a key role on all the outdoor construction activities. By far, most of the projects are completed at or slightly beyond targeted expectations. The authority administers four major international airports in India - Bombay, Calcutta, Delhi and Madras. International airports of Amritsar and Trivandrum would soon be administered by them also.

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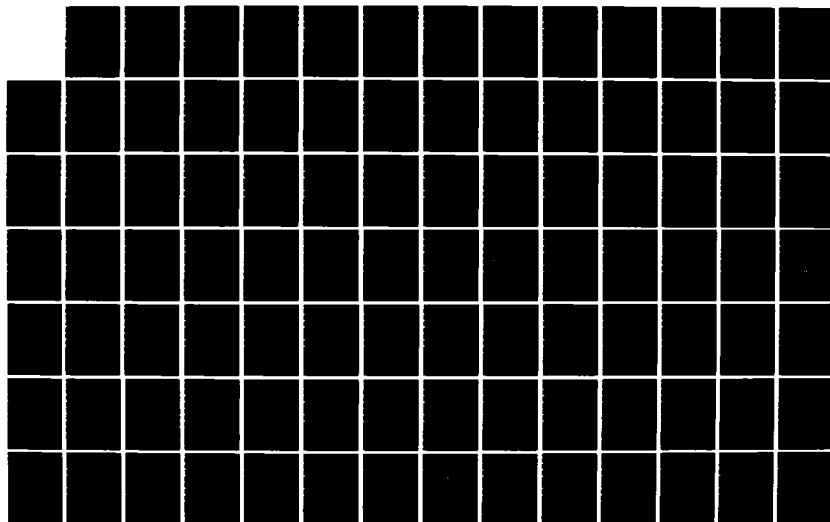
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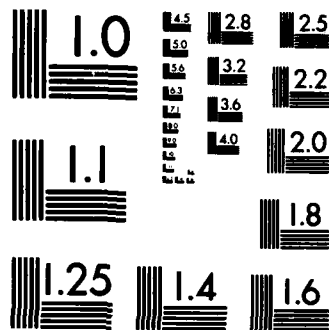
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5.4 PERSONNEL

Safety in the air as well as on the ground is of vital importance to civil aviation industry. A small human judgement or mechanical error not only endangers human life but it also has tremendous impact on the psychology of general travelling public on whose confidence the commercial aviation thrives. Safety in air transport depends on many factors such as (1) pilot skill, intelligence and training, (2) adequate flight control, (3) properly maintained flight and other equipment, (4) adequate airport facilities and (5) a strict follow up and understanding of rules designed to promote safety. Indian civil aviation industry claims to have one of the best trained staff in Asia. They provide training not only to their own personnel but also to the personnel of Indian Air Force and other airlines. Indian airline trained personnel, both pilots and technicians, are in demand by foreign countries where they are offered higher pay and better facilities.

5.4.1 Staff Categories

The staff categories of both Air India and Indian Airline include pilots/copilots, other cockpit personnel, cabin attendants, maintenance and overhaul personnel and ticketing and sales staff. For the purpose of this study, only the following categories of staff are described in detail. The breakdown of various staff is presented in Table 14.

5.4.1.1 Pilots/Copilots. Both the airlines during the early part of their operation when training facilities were not adequate, have hired retired or discharged air force personnel as pilots. This trend has been changed in the last decade and now a larger majority of the pilots hired are non-military personnel. Based on inquiries for the purpose of this study, the current mix of pilots which are direct hire and ex-air force personnel is about 60-40.

5.4.1.2 Other Cockpit Personnel. Other cockpit personnel include flight engineers, radio operators, and navigators. Both airlines draw their other cockpit personnel from various polytechnic institutions, from university graduates and from ex-air force technicians who have several years of related experience. After being hired, each person is provided comprehensive practical as well as theoretical training.

Training for its operating crew, technicians and other administrative as well as support services is provided inhouse by both the airlines. Air India has its entire training base at Bombay while Indian airlines facilities are located at Delhi, Bombay and at Hyderabad.

The selection process of airline personnel follows a pattern of advertisement, interviewing, testing and selection of suitable candidates, followed by a complete physical examination by the airlines' own doctors. Occasionally flight engineers are also recruited from among the aircraft maintenance staff. The flight engineer's training is based on a minimum of 100 hours flight experience. The radio operators and navigators have to be licensed before they can work with the airlines.

5.4.1.3 Maintenance and Overhaul Personnel. The maintenance and overhaul personnel are also either ex-air force personnel or direct recruits by the airline. These technicians are given extensive task oriented training before they are considered qualified mechanics.

5.4.2 Training

As aircraft are becoming more and more complicated, the demands for supporting services in engineering, airports, telecommunications and air traffic control are growing. The flight and ground safety requirements are becoming severe and under the auspices of International Civil Aviation Organization

(ICAO), of which India is a member, these requirements are being imposed on airline operators. Indian Aircraft Rules 1937 consists of regulations governing all the airline safety aspects. The Research and Development Organization of the Indian Civil Aviation Department is responsible for research in engineering problems relating to modifications and repair of aircraft and operational problems concerning aircraft performance. They provide advice on aviation matters and advanced aeronautical training. The air routes and aerodromes directorate is responsible for construction and planning of airports and air traffic control. As operators, both the airlines are responsible to these agencies in aircraft and operational safety matters.

A prerequisite to join Air India as a pilot is a minimum of 1,000 hours on a jet fighter or 1,500 hours of command experience on multi-engined aircraft of not less than 26,000 kilogram gross weight. On being selected, the pilot undergoes very comprehensive training courses, beginning with an eight-week training course designed to provide him with a thorough engineering background of the Boeing 707. He studies such subjects as characteristics of swept-wing jet transports, engines and the various aircraft systems, including fuel systems, hydraulics, electrical operations and avionics. At the end of the course he must appear for the technical examination conducted by the Directorate General of Civil Aviation.

During the training period, he is also sent to the Air Force School of Aero Medicine at Bangalore for a four-day high altitude indoctrination course. As a part of training, he is locked in a sealed chamber, in which pressure and oxygen are controlled to simulate conditions prevailing at jet altitudes to demonstrate to the pilot the effects of lack of oxygen on

the human body. A new pilot also undergoes a seven-day course in high altitude meteorology and flight planning.

The pilot training also includes operations on a simulator of the Boeing 707 which is one of the most effective training aids available for training. It consists of a nose section of a Boeing 707 complete in every detail, mounted on hydraulic jacks with a series of electronic computers to actuate instruments, create control responses similar to those encountered on an actual aircraft in flight. During this training, the trainee pilot learns, in a total of 10 profiles, everything from cockpit familiarization to engine starting procedures, from general handling of the aircraft to complicated instrument procedures, and from coordinated turn to handling of emergencies. For 20 hours, he does these from the left hand seat and for another 20 hours he watches another pilot do them from the right hand seat. With this extensive simulator training, the trainee pilot begins flight training on the aircraft which takes about six hours, depending on the pilot's ability.

A newly trained pilot initially acts as a supernumerary crew member and later as first officer only on certain sectors with a check pilot observing his performance. After he acquires the necessary proficiency he is allowed to perform the duties of a first officer. In cases where the first officer is to become a commander, he must have a minimum of 1,000 hours as a first officer after completing a technical refresher course, simulator and local training, after which he undergoes a route checks under a Senior Check Commander for a final assessment before being allowed to fly as Commander.

Only senior Air India commanders with many years of experience are selected to fly the Boeing 747. The first few

batches of pilots and flight engineers were trained at the Boeing Company's Ground School and the Pratt & Whitney Service School in the USA. The initial training programme involved three weeks of ground training covering every technical aspect of the Boeing 747, one week of engine course and eight hours of flight training in Seattle, Washington. Since 1972, the entire training of Air-India's Boeing 747 flight crew is provided at Air India's Operations Training Centre at Bombay, where a Canadian Aviation Electronics Boeing 747 digital flight simulator has been installed. The simulator, with a six-degree motion system, precisely duplicates every function of a Boeing 747 including take-offs, landings and cruise with the normal sounds encountered in an aircraft such as engine noise, radio, wind, rain and the landing gear rumble. The simulator is also fitted with a visual system, known as Novoview 6000, which uses a computer to generate a night scene in color including the full range of airport lighting, runway surfaces and markings.

Technical Training Curriculum

Air India draws its technicians from the ranks of engineering diploma holders, ex-Air Force technicians and from among those who have five to seven years mechanical workshop experience in the industry. Air India also takes trainee technicians who are given training for about two years on the job. They come to the Training Division for about six weeks of classroom work and spend the rest of the time in the hangar on the job with emphasis on practical training. Basically, the training curriculum is task oriented, rather than inspection oriented.

The Training Division has a well equipped library and makes extensive use of films and projectable demonstrators, which show the inside working of the various control systems of the aircraft. Most of the demonstrators are fabricated from scrap

material in the small workshop attached to the Division. The Indian technicians have fabricated, entirely from scrap, a trainer panel showing the Boeing 747 flight control system which is extensively used for training purposes.

The Training Division offers a wide range of courses on both the Boeing 707 and the 747, covering airframes, engines and systems, including specialized courses on equipment. The courses are formulated after consultations with manufacturers or based on the Division's own experience and expertise. The Training Division is approved by the Director General of Civil Aviation (DGCA) and the courses offered by it are recognized by the DGCA. The courses offered by the Training Division range from a three-year course (which prepares newly recruited graduate engineers) for the Aircraft Maintenance Engineer's 'A' (airframe) and 'C' (engines) license examination by the DGCA, to shorter continuing education courses. The whole training program is drawn up to meet specific requirements and keeping in mind the needs of the Engineering Department and outside commitments of the airline.

The three-year course for new engineers involves only about 25 percent classroom work, the rest of the time they spend on the job in the hangar. The new engineers get a thorough grounding in aviation engineering, including legislation, with emphasis on practical training. The training program is broken down into three distinct phases. In the first phase, they have to master the basics of aviation engineering. Typically, spending their first six weeks in the classroom studying such subjects as the theory of flight and airframes in general; they spend eight weeks in the hangar to study the related hardware. They devote the next four weeks to the study of jet engines in the classroom, followed by a period in the jet shop and finally a study of ancillary equipment, with shop visits.

The first phase of the study lasts for about a year. After which they study Boeing 707, its airframe, engines, the various systems and avionics. Again the pattern is the same as in the first phase which is classroom work on airframe with practical training in the hangar, followed by the engines and systems studies. The last year of the three-year course, they spend entirely in the hangar, working on the aircraft, putting into practice their training before taking the DGCA Examination for 'A' or 'C' license. Once these engineers are qualified as an Aircraft Maintenance Engineer on the Boeing 707, they could get further training to qualify on the Boeing 747. Those engineers qualified on 707s, and with the necessary experience, can qualify for the 747 after about 10 weeks of classroom work and an oral examination conducted by the DGCA. Apart from its own employees Air-India also trains personnel of Zombian Airways, Kuwait Airways, Air Mauritius, Air France, and British Airways.

Refresher courses as well as courses to upgrade knowledge in changing equipment technology are offered throughout the year. Generally airline's education and training standards are considered high and Indian engineers and technicians are considered very competent and innovative by the industry. Even those aircraft overhauls which ordinarily would be performed outside the country are performed in India by these technicians. The maintenance of Boeing 737 aircraft which are leased to Indian Air Force are also performed by airline technicians.

5.4.3 Affiliations

The various categories of employees belong to their respective professional associations which include All India Aircraft Engineers Association, All India Flight Engineers Association, Indian Airlines Officers Association, Commercial Pilot Association and Air India Cabin Crew Association. As both the airlines are Government controlled, strong ties with

political parties are discouraged. Although in the past, there have been several labor strikes and lockouts particularly of the maintenance facilities, but since 1982 the labor relations between management and employees are good.

5.5 COMMUNICATION SYSTEMS

Communications set up in India are multi-faceted and extensive and they offer a total coverage of the entire nation during peacetime and/or emergencies. Depending on the operating agency, the communication set ups can be classified into 7 groups.

- a. Government communication network
- b. Military Network
- c. Director General of Civil Aviation
- d. Director General - Meteorology Division
- e. Airline networks - Indian Airlines (Central Operations)
- f. Police network
- g. Railway network

These groups communicate with each other through a combination of equipments available at their disposal which includes the following communication elements.

1. Telephone - direct - hotline
2. Teleprinter - inhouse - any station to any station (domestic)
3. Teleprinter - international
4. SSB (single select band) HF AND VHF
5. AFTN (Aeronautical fix telecommunication network)
6. Mobile services (Units)
7. ACS/WT (Aero Communication Service/Wireless Telecommunications)
8. Microwave - Police
9. Microwave - Railways
10. Courier

The following illustrates the communication facilities available with various agencies.

1. Govt. Set Up - includes elements of 1,2,3,8,9,10
2. Military Set Up - includes elements of 1,2,3,4,6,7,8,9,10
3. Dir. Gen of Civil Aviation - includes elements of 1,2,3,4,5,6,7
4. Dir. Gen Meteorology - includes elements of 1,2,3,5,6,7
5. Centops (Indian Airlines) - includes elements of 1,2,3,4,10
6. Railways and (7) Police Set Up - includes elements of 1,2,3,4,8,9

As stated earlier, various airports of India have been categorized in terms of facilities available as such that category I airports have maximum communication facilities and category IV minimum facilities. Figure 14 presents this relationship and also presents a communication flow between airlines and various Government agencies in India.

Three facilities are common to all airports, namely telephone, telex, and teleprinter. Remote locations may also use couriers as an additional facility. During emergencies, communication between Government, military and other civil agencies is achieved through usage of a common element available or with a combination of ground to air and air to ground communication set ups. Indian Airlines communication network consists of four regional operations units (Figure 14) which are connected to a control or main unit at Delhi. Madras region additionally covers Hyderabad and Bangalore regions as well.

5.5.1 Avionics and In-Flight Communication

A list of equipment contained in various aircraft for in-flight communication is presented in Table 15.

5.5.2 Ground Communications/Navigation Aids

Major civil airports have the following set of visual and electronic navigational aids in varying combination.

1. **ALS - Approach Light System** - An airport listing facility which provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with extended centerline of the runway on the final approach for landing.
2. **Runway Lights/Runway Edge Lights** - Lights having prescribed angle of commission and define lateral limits of a runway. They are spaced at intervals of 200 feet and their intensity can be preset or controlled.
3. **Touchdown Zone Lighting** - Two rows of transverse light beams located symmetrically about the runway centerline normally at 100 foot intervals.
4. **Runway Centerline Lighting** - Flush with centerline these lights are spaced at 50 foot intervals beginning 75 feet from landing threshold and extending to within 75 feet of the opposite end of the runway.
5. **Threshold Lights** - Fixed green lights arranged symmetrically left and right of the runway centerline identifying the runway threshold.
6. **Runway End Identifier Lights (REIL)** - Two synchronized flashing lights, one on each side of threshold to provide rapid and positive identification of approach end of a particular runway.

7. Airport Rotating Beacon - A visual NAVAID at all the airports. At civilian airports, alternating white and green flashers indicate location of the airport. At military or military controlled airport the beacon flashes alternately white/green but differentiated from civil airport by having two quick white flashes and a green flash.

In addition to these basic visual aids major airports are equipped with additional aids as described below:

VOR/Very High Frequency Omni Directional Range Station - A ground based electronic navigation aid transmitting high frequency navigational signals, 360° in Azimuth, oriented from magnetic north. VOR periodically identifies itself by Morse Code and may also have a voice identification feature.

ILS/LLZ - Instrument Landing System/Localizer - A precision instrument approach system which consists of following electronic components:

Localizer (LLZ) - Provides course guidance to the runway.

Glide slope (GS) - Provides vertical guidance for aircraft during approach and landing

Outer Marker - A marker beacon at or near the glide slope. It is keyed to transmit two dashes per second on 400 Hz tone and is received either visually or by compatible airborne equipment. It is normally located 4-7 miles from the runway threshold on the extended centerline of the runway.

Middle Marker - A marker beacon to define point along glide slope of an ILS at or near the point of decision height. It is keyed to transmit alternate dots and dashes, two per second on 1300 Hz tone received visually or by compatible or airborne equipment.

The other navigation equipment present at the airport includes the following.

DME (Distance Measuring Equipment) - Equipment (airborne/ground) used to measure, in nautical miles, slant range distance of an aircraft from the distance measuring equipment.

GP - Glide Path - Used by ATC (Air Traffic Controller) to conform an aircraft making a precision approach of its vertical position relative to the descent.

NDB - Non Directional Beacon/Radio Beacon - An L/MF or UHF radio beacon transmitting nondirectional signals whereby pilot of an aircraft equipped with direction finding equipment can determine the bearing to or from the radio beacon and "home-in" or talk to or from the station.

TVOR - Terminal - Very High Frequency Omni Directional Range Station - An approach aid located at or very near the airport.

A list of Indian airlines airport network and their navigation aids is presented in Table 16. Table 17 presents a glossary of terms. Major international airports located at Bombay, Calcutta, Delhi, and Madras are now equipped with Precision Approach Radar (PAR).

5.6 MAINTENANCE FACILITIES

5.6.1 Overview

Both Air India and Indian Airlines are entirely self-sufficient in their engineering and maintenance facilities. Air India's major maintenance base is located at Bombay Airport and is provided with hangars equipped to handle maintenance work of the entire Air India fleet, including complete overhauls and repairs of jet engines. Indian Airlines maintenance facilities are located at Delhi, Hyderabad, Bombay and Calcutta. Both the airline performs most of their maintenance inhouse by Indian technical and operational crews. The airlines train their own staff and have built extensive training facilities for the purpose. No foreign aid or assistance is sought in any aspect of maintenance work at the present time.

5.6.2 Capacity and Capability

5.6.2.1 Air India. Air India's Engineering Complex at Bombay Airport is one of the most modern in Asia, with comprehensive facilities for maintenance and overhaul of Boeing 747s, Airbuses, and Boeing 707s. The facilities are spread over an area of approximately forty acres. These facilities are certified as being entitled to issue "Approved Repair Certificate" by the Federal Aviation Administration of the United States and also by the Civil Aviation Administration of

Japan, for the repair and overhaul of airframes, power plant, radio, instruments, and accessories. Apart from the heavy maintenance of the aircraft, Air India is capable of handling major structural modifications and painting of wide-bodied aircraft and repair of major components including accessories, avionics, and flight instruments. The 747 hangar has facilities to repair and overhaul cabin equipment including chairs, galleys, lift rafts, and escape slides. Air India's Jet Center offer facilities for overhauls, and repairs, JT9D, CF6, JT3D, Convay, and Avon engines.

Air India's Jet Center consists of a main wing with an area of 60,000 sq. ft. for engine strip and assembly, a separate wing of approximately 12,000 sq. ft. for power plant build-up and modular maintenance of the JT9D engines and a third wing to repair engine components. It has two engine test houses, one capable of handling engines up to 50,000 lbs. thrust, and the other capable of testing engines with a thrust of up to 100,000 lbs. The support facilities of the engineering complex include a separate division staffed by quality control, production planning, performance engineering and facilities planning divisions.

Air India's accessory overhaul shop overhauls and tests all the four major systems of Boeing 747s and 707s including electrical, hydraulic, pneumatic, and fuel systems. The facility handles servicing of more than 1,000 different major components of these systems and is fully equipped to test all the fuel system components of the 747 engines including fuel control unit, fuel pump, and other engine fuel system components. Most of the specialized equipment to simulate inflight conditions for testing the systems are designed and manufactured in India. For testing pneumatic units, three

indigenously made compressors are installed, each compressor is capable of giving an air flow of about 1,400 cu ft per minute.

The maintenance facilities operate day and night, seven days a week and work is performed with tightly planned schedules. The Maintenance Group consists of three separate divisions which include Line Maintenance, Major Maintenance, and Component Overhaul. The Line Maintenance Division deals with day to day problems such as engine changes and routine maintenance checks to keep the fleet in operation. Major maintenance on the aircraft is performed by Major Maintenance Division. Component Overhaul Division performs structural modifications and repairs as well as overhaul and repair of major components such as landing gears, flaps, engine cowlings, and certain components of the fuel and oil systems.

After every 1,000 hours, a Boeing 747 undergoes Check 'A', which involves a complete inspection of the aircraft, including its hydraulic and electrical systems, landing gear, wheel-valves, and engines. In between 'A' checks, the aircraft is also inspected at every airport it touches en route for routine checks and emergency repairs, if any. A Check 'B' is performed in the hangar at Bombay Airport after every 200 hours. The latter is somewhat less comprehensive than the Check 'A'. A specialist team of avionics engineers and technicians check the avionics which includes a thorough check of all navigation and communication systems during the Check Bs.

Air India schedules major maintenance checks every 4,000 hours. In addition, internal and external detailed inspections are carried out every 4,000, 8,000, and 12,000 hours as per maintenance program. Specialized tests with Eddy Current,

Ultrasonic, and X-Ray equipment are carried out during these checks to detect structural defects in the aircraft. The maintenance pattern for the Airbus is essentially the same as the Boeing 747. Air India performs the line maintenance on the aircraft and the aircraft are sent to the maintenance base at Bombay for Check 'A' scheduled every 300 hours. The major maintenance checks are performed every 3,000 hours.

Maintenance equipment of Air India is presented in Table 18. The maintenance schedules are sometime modified to reflect improved performance of the parts. For example, the major maintenance checks on the Boeing 707 are now being performed at every 1,800 hours as compared to the original 200 hours and a block overhaul is scheduled every 12,000 hours. These major checks are done in two phase, at intervals of every 6,000 hours, to avoid grounding of aircraft for prolonged periods.

5.6.2.2 Indian Airlines. Indian Airlines' carries all its maintenance jobs inhouse at their facilities located at Delhi (737s) Bombay (Airbuses), Calcutta (F27s) and Hyderabad (HS 748s). It does not send its Boeings and Airbuses abroad for maintenance and only twice it has needed to bring a Boeing technical team to Delhi with support equipment such as jigs and fixture. Now Indian Airlines has built its own jigs and tooling for all critical maintenance jobs. By carrying out its own maintenance on its 737s and Airbuses, Indian Airlines pays only about 30 percent of the cost it would incur by contracting out the work. According to one estimate about 95 percent of Boeing 737 air frame maintenance is performed inhouse, and so is 80 percent maintenance of Airbus frame work. Indian Airlines carries out about 40 percent of A300CF6 engine maintenance and the remaining is performed by Air India.

Indian Airlines performs all of Air India's A300 heavy airframe maintenance. It is largely due to Indian Airlines experience in airbus maintenance that Air India introduced the A300 for commercial operations last year within six months of ordering the aircraft.

Indian Airlines has reduced its maintenance cost through enhancement of the period between inspection checks. Such developmental efforts resulted in increasing the validity of Flight Release Certificate of F-27 aircraft from 160 hours/40 days to 250 hours/60 days elapsed time. Similarly, on HS 748 aircraft, the elapsed time of Check 1 is now enhanced from 65 days to 75 days.

5.6.3 Maintenance Schedules

The schedule of maintenance and overhauls are well within the specific minimums laid down by the manufacturers and due to a multi operational flights feature of every aircraft these accelerated schedules are in essence necessary for the upkeep of the fleet. Both the airlines judge their maintenance standards on the concept of time between overhauls and sometimes perform more than average maintenance and performance check on aircraft, if necessary. Maintenance schedules of Airbus, Boeing 737 and HS 748 are presented in Tables 19, 20, and 21.

5.6.4 Availability of Spares

Procurement of spare parts is generally not a major problem for Air India as well as Indian Airlines engineering and maintenance management. Intermittent delays in spare parts procurement do sometimes cause difficulty in the airline's routine operation. However, no serious incident of increased

lead time for spare part procurement has been reported in the near past. The current ratio of stores holding to aircraft fleet is only around 10% on an average.

5.6.5 Maintenance Effectivity

Air India performs 100 percent maintenance work inhouse. It trains its own staff in all aspects of airline operations and has built extensive training facilities for this purpose. The airline's engineering complex has been granted "Approved Repair Facility Certificate" by the FAA for airframes, power plant, radio, instruments, and accessories. Air India has acquired the latest equipment, and emphasis is on the highest standards of service and efficiency. Both the airlines have achieved self-sufficiency in all aspects of airline operations including facilities, maintenance, and training.

Indian airlines takes pride in their engineering excellence. The airline has high technical education standards and it trains its staff thoroughly in all maintenance functions. Although some components on A300s and B737s are now maintained on an on-condition basis, the airline carries out checks more frequently than most other airlines. Table 22 presents Indian Airline Equipment condition and maintenance effectivity.

The Indian airline's engineering staff has won official recognition of the Boeing in the past. The manufacturer has awarded Indian Airlines a citation for the on site work carried out on a B737 that Boeing claimed could not be done, without taking apart the aircraft's entire tailplane assembly. The engineering staff has devised a special jig to hold the assembly up away from the obstacles, and did the repair overnight. Due to high standard of maintenance requirements

and strict adherence to the rigid schedules both airlines show a technical regularity of about 98% on their engineering performance.

The airlines are not without problems. The engineering and maintenance management faces constant problems of the exodus of skilled engineers and technicians to airlines in the Middle East and Southeast Asian countries. Another problem is the dusty and hot environment which are not compatible with normal operating conditions for turbofan engines. Reliability of high bypass turbofan engines for operation in these conditions is a problem. Indian Airlines has recently reported a new series of corrosion problems on its old B737 which include cracks caused by corrosion in the stress areas around the bottoms of rear pressure bulkheads. Indian Airlines is carrying out intensive inspections and taking measures to correct this severe corrosion in the pressure bulkhead separating the air conditioning bay from the forward cargo bay. Indian Airlines has also found a skin-bonding delineation problem in B737s and in A300s since they began operation.

5.7 CIVIL/MILITARY INTERFACE

As in most countries of the world, civil aviation in India is recognized as a back up of military forces in the event of national emergency. It reinforces military air power and supplement its capabilities by supplying men, machines, communication networks, and repair and maintenance facilities on short notice. Logistics mobility has always been a decisive factor in any armed conflict and this mobility is achieved through air carriers. Indian civil aviation cooperates and interfaces with military during both peacetime and during emergencies, though the nature and the extent of their interface differs in both the situations.

5.7.1 Civil/Military Interface: Peacetime

India has a total of 89 airports listed for commercial and civilian traffic. The activity of these airports varies. As described in Section 5.5, most of the civilian airports have some form of basic communication and navigational equipment. There are certain airports such as those located at Agra, Cochin, Chandlingarh, Dabolin, Pune which are military airports and permit civilian air traffic in peacetime. Typically these have an airport manager and other employees who belong to either civilian agencies or to the military which perform fueling, ramp service as well as fire fighting and handling flight safety equipment services. Generally, the air traffic controllers are civilian employees. An air force officer designated as chief operations officer is present at all times at these airports. He coordinates with the civilian airport manager for various peace time military aviation activities. He is responsible for upkeep and maintenance of air force property, including ground support and other navigational and technical equipment and provides assistance during any military operations.

5.7.2 Civil/Military Interface: National Emergency

Once an emergency is declared by the Government, all airports and communication facilities automatically come under Government command. Generally this does not constitute significant changes in the civilian airport operations, although certain procedural and administrative changes are effected at combined military/civil airports. At these airports, the chief operations officer of the Air Force assumes command of the station. All civilian flights are either operated at reduced frequency or stopped. Control tower is manned by air force controllers. Radio/telephone communication set ups operate as per military requirements described in Section 5.5.

Communication frequencies and equipment usage during national emergencies depend on classified military frequencies.

5.7.2.1 Organization: The 1962 war with China on the northeastern border brought about some concerns in strategic planning and deployment of troops to the areas of national emergency. With two more major wars that followed, considerable planning has gone into effect to achieve better coordination and to reduce last minute planning for the bulk movements of men/machines to the areas of concern/conflict. As a part of emergency planning, generally before involving civil aviation, armed forces evaluate their own resources for mass movements which include:

- Air Force Transport Aircraft
- Trucks and Road Transport Vehicles owned by Armed Forces
- Ships and Naval Aircraft
- Railway System

In the event that civilian aircraft participation becomes necessary, the following basic command, control and communication plan has been used in the past deployments.

5.7.2.2 Command, Control, Communication

The Prime Minister of India with the consultation of the cabinet declares state of emergency during the war time. The cabinet on assessing the military resources and situation directs Ministry of Defense (namely Defense Minister) to execute its directives. Ministry of Defense in consultation with chiefs of staff of all three forces, develop specific implementation plan of action including assistance from the civilian agencies. Ministers of Civil Aviation, as well as

Communication and Transportation are also involved in the decision process, while Ministry of Finance provides financial commitments. A joint communique is generally issued with instructions for the use of railways, road transportation or civilian automobiles and civil airlines.

For the use of civil airlines, for military purposes, the Minister of Civil Aviation in consultation with Chief of Staff, Indian Air Force issues directive outlining nature of movements and their frequencies. Although it may seem intricate, the whole process takes about 12 hours or sometimes less after initiation. During national emergencies, the military has the decision making role and functions are performed by the civilian airlines under military's command and overall control. The communications flows depend on the availability of various networks as described in Section 5.5. Once called upon during war time emergency, all civilian agencies and their employees come under federal laws governing the emergency and offenders are subject to punishment for non-compliance. The support in all previous wars has been whole-hearted and total by all civilian agencies. Figure 15 represents civil/military interface during emergencies.

5.7.3 Past Use of Civil Airlines During Emergencies

In the past Indian Airlines has been called upon to provide aircraft on following occasions:

- Evacuation of refugees immediately after the partition of India and Pakistan during which period Indian civil aviation carried about 10,000 refugees.

- Air lifting of food supplies and personnel on a large scale to Kashmir front in 1947. During a three week period, 750 non-scheduled round trips were made between Delhi and Srinagar, carrying a load of approximately 60,000,000 pounds over a total distance of 620,000 miles.
- Air lift of troops from Eastern front to Western borders in the 1971 war with Pakistan
- Airlift of paramilitary forces to subdue riots in distant and sometimes inaccessible parts of the country
- Air dispatch of food, drugs, and essential relief to the affected areas after natural calamities or in post war periods.

5.8 FUTURE OUTLOOK OF AIRLINES

5.8.1 Aircraft

Financially, both Air India and Indian Airline are in a strong position to plan major expansions of their fleet. Air India has replaced all but one B707 aircraft and Indian Airlines need to replace its existing fleet of 737s. Air India made a profit of US \$34 million in 1983 and projections for profits in 1984 are US \$60 million. For the purchase of new aircraft, Air India's choice seems to be either Boeing 767 or Airbus A300 with the Airbus 310 as a possible option. According to aviation industry sources, both Airbus and Boeing corporations have reduced their prices to around US \$40 million - 45 million an aircraft. Boeing has also offered to buy back the old 707s and to give India a discount of US \$25 million on five more 747s that the airline may buy in the future.

Indian Airlines' profit in 1983 were US \$13.5 million and a US \$21 million profits are projected for 1984. Indian Airlines' passenger volume is expected to double by 1990. For Indian Airlines new aircraft purchase, Boeing 757 looks a formidable contender because it can use many airfields originally built for the much smaller Boeing 737. Indian Airlines already has A300s, and is likely to order more Airbuses for its busier routes. But the real competition is for the lesser routes, where the narrow body Boeing 757 has the edge in cost savings over the widebody A310. The expectations are that the Indian Airlines will order three Airbus A300s and five Boeing 757s in 1984. As both the corporations are state controlled, political rather than economic considerations will play a decisive role in aircraft buying decisions.

5.8.2 Airports

Major airport expansions are planned at Delhi, Bombay, Madras and Calcutta. At Delhi, US \$64 millions are being spent on international passenger terminal and on a new cargo terminal. These expansions are expected to be completed by 1985 and are being performed by International Airports Authority of India (IAAI). In addition to the construction, purchase of auxillary equipment for cargo terminal is also planned which includes the elevated transfer vehicle with a two million ton annual handling capacity.

At Bombay, the international terminal is being expanded at a cost of US \$22.5 million which will increase the passenger handling capacity to a 5 million passengers per year and the airport's total to 8 million passenger per year. There is a possibility to move the airport but the final site is not decided as yet.

Madras will have a \$10.5 million new domestic terminal to be completed by the end of 1984. It will handle about 1.2 million passengers a year. A new domestic terminal for Calcutta is also planned to be built in the 1985-90 period.

5.8.3 Facilities

Indian Airlines is planning a new JT8D hot-section inspection facility at Delhi as a part of a complete JT8D engine assembly and maintenance facility. This facility is expected to be fully operational in three years. New construction or expansion of Indian Airlines Airbus facility is also planned in view of airbus fleet expansion of both the airlines.

These projections of acquiring larger and more sophisticated aircraft as well as expansion of runways and other allied ground facilities reflect the Country's quest for modernization which when completed will provide a significant support environment during national and war emergencies. The civil airlines and air services will be in a better position to serve the needs of the military after these anticipated expansions.

5.9 Military Aircraft

5.9.1 Indian Air Force

Indian Air Force (IAF) is one of the most powerful air forces in Asia. The IAF has about 635 combat aircraft and employs 113,000 personnel. The air defense of the country rests with 20 squadrons; 14 are equipped with various versions of Russian MiG 21s, four with Folland Gnat FMK1, and two with the HAL Ajeet.

For offensive functions, IAF has 11 fighter-ground attack squadrons equipped with Sukhoi SU-7BM, Hawker Hunter FMK56, HAL Marut MK1 SEPECAT Jaguar. These squadrons are supplemented by four light bomber squadrons and two tactical reconnaissance squadrons using Canberra PRMK57 and MiG-25R aircrafts.

The IAF's transport capabilities rest with 10 transport squadrons: two have Fairchild C-119G aircraft (being replaced by Antonov An-32s); three have Douglas C-47s (also being replaced by An-32s), two have Antonov An-12s; two have de Havilland Canada DHC-3 Otters; and one is equipped with de Havilland Canada DHC-4 Caribou aircraft. The IAF has one communication and two liaison aircraft equipped with BAe HS748 twin-turboprop aircrafts. The IAF has eight helicopter squadrons which could be used for transport, observation, and as light attack units.

In the last few years a shift has been observed in the IAF equipment acquisition strategy from a reliance on the Soviet Union to the western countries. The Jaguar is already in licence-production and service, and the Dassault-Breguet Mirage 2000 multirole fighter is on order to serve as primary air defense aircraft. The IAF has ordered a number of An-32s for transport that may be supplemented by Ilyushin Il-76 aircraft to meet the needs of heavy equipment transport. The IAF also has a force of 30 squadrons equipped with some ISO SA-2 Guideline and SA-3 GOA missiles.

A list of IAF flight equipment is presented in Table 23. Table 26 presents a comparison of the airlifting capabilities of military and civilian aircraft and shows the extent of increased capacity which the military acquires by the use of civilian aircraft.

5.9.2 Indian Navy

The Indian Navy (IN) has 60 combat aircraft including helicopters and its air arm employs about 2000 personnel. The Navy is planning to boost its attack capabilities by acquiring BAe Sea Harrier aircraft. The current fixed-wing anti-submarine responsibility is assigned to one squadron with Dassault-Breguet Alize aircraft while the rotary wing ASW is undertaken by five squadrons equipped with Westland Sea King, Kamov Ka-25, and Aerospatiale Alouette III helicopters. Maritime reconnaissance is performed by two squadrons, one equipped with Ilyushin 11-38s and the other with L-1049 Super Constellations, which are being replaced with Ilyushin 11-38 aircraft. The liaison and search and rescue operations are performed by a squadron equipped with Alouette IIIs and three training and communication squadrons with a number of fixed- and rotary-wing aircraft. Limited transport and coast patrol capabilities are provided by five Norman Islanders aircraft. Table 24 presents the flight equipment of the Indian Navy.

5.9.3 Military Airports

Table 25 presents a list of military airports in India. It is reported that these airports could land civilian aircraft during emergency situations.

6.0 OTHER TRANSPORT SYSTEMS

6.1 INDIAN RAILWAYS

The Indian Railway System is one of the largest and oldest in the world. Since independence, the Railways are run by the Federal Government. The Indian Railways not only provide the facilities to move passengers and commodities, but also have production units for manufacturing locomotives, coaches, wagons, signalling and telecommunication equipment. The highest policy making body for the railways is the Railway Board located at Delhi.

Indian Railways carry nearly four billion passengers and 270 million tons of freight annually, on a 38,000 miles network of track with 7,072 stations spread all over India. The track system is comprised of three interconnected gauge systems which include Broad Gauge (width 5.5 ft.), Meter Gauge (width 3.25 ft.), and Narrow Gauge (2 ft. and 2.5 ft.). Route map of Indian Railways is presented in Figure 16.

Railways in India perform strategic, social and economic objectives. The strategic objective is to provide adequate economic and efficient rail transport and an optimum infrastructural support to the economy. The social objective is to provide safe, comfortable and fast passenger and freight transport at reasonable cost to the users. The economic objective for railways is to be an economically reliable system without being a burden on the national exchequer. These objectives are achieved by adopting proper freight and transport policies as well as fare structure with a view of generating internal resources for development and growth.

During war emergencies, mass movement of equipment and troops have taken place by railways. As railways in India are Federal Government controlled, rescheduling or priority treatment for military purposes is not a problem. The strength of railways for mass movement of troops include:

- Railways are the cheapest and fastest land transport system for long leads of bulk commodities and passengers.
- They are more efficient in energy consumption because of low rolling resistance. Adequate and cheap electric power and diesel oil is available in India.
- Railways have an extensive and reliable microwave network of communication. Computerized information technologies are being introduced.
- Railways have skilled workforce which is capable of adaptation to emergency conditions at a short notice.

One of the drawbacks of the Railways is its gauge system which is not being uniform throughout the system which entails reduction in speed. Also, the productivity of the railway's maintenance units suffer from lack of sophisticated machinery. Being a Government department, the organizational and technical set up to acquire modern machinery and plant are inadequate.

In order to save on fuel and to provide long haul and speedy transport, Indian Railways are planning electrification and gauge conversion of their system. Although they will create pressure on line maintenance, these changes will result in more intensive utilization of the line and terminal capacity. The new purchase and construction plans include

purchase of electric locomotives and electric multiple units, steam and diesel locomotives, shed and loco facilities to take care of both the new demands as well as the replacement of existing rolling stock due to age and depreciation. Efforts are also being proposed to improve coordination and control between the railways, the roadways and the airlines. All these efforts will offer better facilities for military during any national emergency in future.

6.2 TRUCKS

About 30 percent of material transport in India is performed by roadways using trucks. Generally, the trucking companies are privately owned and they operate specific routes under permit by the transportation department. During war emergencies, due to shortage of fuel or blackouts, trucks operate under restrictions. During war emergencies, the military could acquire the use of local trucking companies on a priority basis under the emergency laws. One drawback of using the Indian trucks for military purposes is their lack of performance reliability as the companies operate with a high profit motive and in a very competitive environment often at the cost of essential maintenance. Generally, the ratio of trucks to railway carriages in India works out to approximately 3 trucks to a carriage. Although no definite quantitative figure can be established, at least 35-40,000 trucks are available in India. Data on the extent of their usage in past wars is not available in any compiled form. Principal roads of India are shown in Figure 17.

6.3 THE USE OF LAND TRANSPORT SYSTEMS DURING EMERGENCIES

Land transport systems, particularly railways have been extensively used in the past as a means of mass troop and heavy equipment movement by the military. The basic steps in the development of an emergency plan are the same as explained in Section 5.7.2.2.

The military does not have its own rail transport system and the administrative liaison between railways and the military is performed by a division of the Army known as MILRAIL. It is the function of this division to ensure instant mass movements of men/material by using railway systems. To achieve this schedule, train operations are sometimes delayed or suspended depending on military priorities. These operations are performed with the consent of the Ministry of Railways and the Chiefs of Armed Forces.

All military movements take priority over civilian functions. Although the basic administrative structure of the railways remain in tact, the decision making and command rests with the military during the emergencies. The communication flow is achieved by using the available networks as described in Section 5.5. No major problems have been reported in the past for use of railways or road transport system for military purposes.

7.0 ASSESSMENT FOR THE FUTURE USE OF CIVIL AIRLINES DURING EMERGENCIES

7.1 EMERGENCY SCENARIOS

Three types of emergencies can be visualized wherein civil airlines may be called upon to participate:

- Assistance and rescue during natural disasters
- Assistance in geopolitical activities
- Assistance in national defense.

7.1.1 Assistance During Major Natural Disasters

India witnesses two to five natural disasters every year. Typically, these disasters consist of excessive rains, storms, and floods; drought, and crop failure; infrequently landslides, fires and other ravages.

Civil airlines are called upon to assist in reconnaissance, airdropping of food, medicine and supplies, and for directing rescue operations. It is expected that similar assistance may be required in the future.

7.1.2 Assistance in Geopolitical Activities

India has participated in peacekeeping and similar other activities throughout the world (e.g., Gaza, Korea). Civilian airlines have been used to transport troops, officers and their equipment to the regions of work. The airlines have also been used in assisting ground units fighting insurgencies by air dropping and transport of supplies to remote locations. Similar assistance may be required in the future.

7.1.3 Assistance in National Defense

During peacetime, civil aviation have a very limited role in assisting the military activities. Some participation in general planning and readiness is the primary focus of activities. During wars, the general approach has been one of minimizing participation by civil airline equipment and personnel. However, all the major wars in the past twenty-five years have seen the use of civil airlines. The circumstances from this use and the contributions of the civil airlines are discussed in Section 8.

8.0 POTENTIAL USE OF CIVIL AIRLINES FOR MILITARY PURPOSES

8.1 POTENTIAL MILITARY PURPOSES

The potential for military activity in the Indian subcontinent is reasonably high. A very likely triggering mechanism for military activity may be the political instability within the countries of the subcontinent and the constant shifts in the relationships between them. External factors such as the global superpower political and military activity can also result in related military activity within the subcontinent. It is difficult to visualize the full range of possible military purposes that could involve the civil airlines of these countries. However, based on recent history and the current geopolitical framework, the following events may be considered to have a reasonable probability of occurrence:

- A limited war (limited in geographic extent and scope of operations) between India and Pakistan, India and Bangladesh, India and China or combinations of these countries.
- A more extensive and prolonged war between India and one or more of the above countries (the activities may extend over several tens to several hundred kilometers).
- A limited military activity along India's southern and eastern sea coasts.
- Participation by India in a joint military activity with another nation.
- Maintaining internal law and order.

The primary contribution of the civilian airlines may be in the loan of its equipment and personnel to provide logistical support to transport military personnel and equipment during initial stages of the war. Often the activities would occur under less than optimum conditions and under considerable uncertainty about the availability and operational effectivity of the airports and support facilities. In India's case, two good examples of such situations are the airlift of troops to Kashmir in the 1948 war with Pakistan and the 1962 border skirmish with China along its eastern frontier.

In 1948 during Kashmir operation almost all strategic positions in the civil aviation were held by released armed forces personnel. These were also supported by personnel of Auxiliary Air Force (analogous to air reserves of USA). Aircraft privately owned by various states of India also participated in the mass movements of troops going in and refugees returning back. The operation lasted for approximately three weeks and involved airlift of 3 brigades and 30,000 tons of equipment between Delhi and Srinagar airports. The number of civil aviation personnel involved in these operations were estimated to be 1500.

In 1962 there was no early element of surprise but realistic measures were introduced almost instantaneously. The response was phenomenal. Civilian airlines had larger capacity available for mass movements of relief operations which were carried out through regional centers with a central origination source (COS) coordinating the actions.

A second contribution of the civilian airlines may be the provision of operating support through the loan of trained personnel and equipment for communication, maintenance, refueling, loading, etc.

A third contribution of the civilian airlines may be to assist in evacuation and provision of medical help. Following wars, civilian airlines have taken active part in air dropping food, supplies and medicine in various remote regions along the NE frontier which had no means of communications and very limited access to transportation.

As described in Section 5-7, the mechanism for bringing the civil airlines into the support of military activities is the interface between the Ministry of Defense, the management of the airlines and the Ministry of Transportation. It is reasonable to assume that future emergencies may require action similar in scope ranging from 1 to 3 times or greater.

During a war the military in India could draw support from Air India, Indian Airlines, and from airline subsidiaries if the military has exhausted its own transport resources or if the use of civilian aircraft offers some strategic or economic advantage. Most likely, uses of civil aircraft would be for the transportation of troops, VIP's, light equipment, arms, ammunition, and medical supplies; transfer of wounded soldiers from the battlefield; aerial reconnaissance of war-affected areas; and transfer of troops to perform peace-keeping missions. The current Indian Air Force and civil airline transportation capabilities are presented in Table 26. The Boeing 737, which the Indian Air Force acquired from the civil airlines, offers the maximum troop or freight carrying capacity. Therefore, the Indian military has the option of increasing its air transport capability by using any or all the civil aircrafts shown in Table 26. The Indian Air Force is planning to increase its own transport capabilities by adding Russian built Ilyyushin heavy transport aircrafts (maximum capacity 140 troops or 88,183 lbs. freight), but until they are

acquired, the present transport capabilities are limited to two 737s and several smaller transport aircrafts. This limitation, depending upon the war situation, may impose a timing or troop strength disadvantage.

Any future military decision to use civil aircraft during a war is expected to use the following selection criteria: (a) the location of war front, (b) purpose of the flight, (c) length of runways at the airport, (d) support facilities, and (e) availability of fuel.

8.2 RESPONSE PLANNING

Response planning involves the military, airlines and support organizations and is carried out as a standard procedure. The Air Force takes the lead, in planning and in updating the plans. The potential for military action and the role of civil aviation in military emergencies does not appear to play a major role in planning, scoping, scheduling and purchasing of civil aircraft. It also does not appear to be prominent in the decisions regarding the location of maintenance facilities, purchase and stocking of spares, training and of maintenance and operations personnel. Although some thought of military applications may be given in the planning process by the ex-military personnel who are represented in the Board of Directors and the operational management of both the airlines.

8.3 READINESS POSTURE

Policy planning for maintaining a good readiness posture is the responsibility of the Defense Department. When needs have arisen in the past twenty years, the response time has been short (6-12 hours), well within the desired limits for mobilization and implementation of the action plans. However,

the level and scope of readiness is variable. Areas of weakness include: ability to maintain and reach standby crews for flight operations, maintenance, ground operations, and communications; ensuring steady fuel supply; maintenance of services. No formal rehearsals or drills to coordinate the activities between the civil and military counterparts are reportedly conducted. Formal indoctrination and training of civil aviation personnel for participation in possible military actions is not evident. The basic approach is for the military to do the planning and take over key decision making and operational functions and the civil aviation personnel to follow their instructions.

8.4 PERSONNEL EXPERIENCE

As has been noted in Section 5.4 nearly 40 percent of the civil pilots, navigators and engineers, nearly 35 percent of those in the ground operations, and 20 percent of those in maintenance have some military background. This training has been found to be very beneficial in integrating the civil aviation personnel into military operations. The military has active representation in the senior management of the airlines which assists in the reducing the response time and directing the civil aviation personnel. As regards the ground operations and support functions, the civil employees do not receive any special training in the handling, loading and transporting of military materials and equipment. The aircraft is not particularly prepared and equipped to be converted readily for heavy military equipment use. Rather, the tendency is to utilize the aircraft with a minimum of conversion and to rehabilitate them for civilian use after the emergency is over. Special training requirements for the civilian airline personnel are therefore, limited. The latest actual personnel experience in the participation in military activities has been limited to the 1971 Indo-Pakistan war.

Since then, only a limited number of exercises are reported to be conducted. These exercises have been limited in scope and did not involve a large number of civil airlines personnel.

8.5 OPERATIONAL SUPPORT

Operational support of the civil airlines activities for military purposes comes from the regular channels. The ground staff, the maintenance staff and the auxiliary services are handled through the same arrangements as for normal commercial operations. Technical staff such as controllers and communications personnel are reinforced by military personnel if joint use of the facilities is anticipated. No special arrangements are made to reinforce support activities such as refueling, cleaning, and aircraft servicing. Arrangements to contact and maintain standby crews are not very sophisticated.

8.6 EFFECTIVITY AND CONFIDENCE LEVELS

The planning, training, and support preparations for making the civilian airline personnel participate in military activities is limited in scope and comprehensiveness. The resources allocated to such efforts are limited. During the past 15 years, actual experience in participation in military activities has also been limited. However, the limited resources and training are compensated by the dedication and the willingness of most technical and nontechnical staff in response to the call for help in a national emergency and participate in whatever actions are called for. Within the framework of limited resources, therefore, the effectivity of civilian airline support has been better than average.

Table 1. LIST OF LIBRARIES USED FOR DATA COLLECTION

TWA	New York
Pan Am	New York
UNO	New York
Douglas Aircraft Co.	Long Beach
Library of Congress	Washington, D.C.
JPRS	Arlington
University of California	Berkeley
Southeast Asian Studies	Berkeley
Internat'l. Civil Aviation Organization (ICAO)	Montreal
Internat'l. Assoc. of Travel Agents (IATA)	Montreal
Air & Space Law-McGill University	Montreal
Woodward-Clyde Consultants	Walnut Creek
Woodward-Clyde Consultants	Wayne

Table 2. LIST OF INDIAN NEWSPAPERS REVIEWED WITH COVERAGE DATES

Amarita Patrika: (English)	Oct.-Dec. '48, Aug. '50, Oct. '55, Aug.-Oct. '65, Aug. '68, Sept.-Oct. '71, Nov. '77.
Ananda Bazar Patrika: (Bengali)	Sept. '65, Aug. '68, Sept.-Oct. '71, Nov. '77.
People's Democracy of India: (English)	Aug. '68, Sept.-Oct. '71, Nov. '77.
Times of India: (English)	Oct.-Dec. '1948, Aug. '50, Oct. '55, Sept. '65, Aug. '68, Sept-Oct. '71, Nov. '77.
Yugandterra: (Hindi)	Sept.-Oct. '71, Nov. '77.
<u>General Coverage</u>	
Indian Express	(English)
Statesman	(English)
Hindustan Times	(English)
Nai Duniya	(Urdu)
Jan Yug	(Hindi)
Tarun Baharat	(Marathi)

Table 3 LANDMARKS - AIR INDIA

Landmarks in the History of Air-India

Oct 15, 1932	Tata Sons Ltd inaugurate the first scheduled service in India with a Puss Moth. Pilot - Mr. J.R.D. Tata, former Chairman, Air-India.
Jul 29, 1946	Tata Airlines converted into public company and named Air-India Limited.
Mar 8, 1948	Air-India International formed.
Aug 1, 1953	Air-India International nationalized.
Aug 15, 1958	Moscow service inaugurated.
Feb 21, 1960	Arrival of first Boeing 707 after a record breaking non-stop flight London-Bombay in 8:05 hrs.
Jun 11, 1962	Air India became world's first all-jet airline.
Apr 18, 1971	First Boeing 747 arrives.
Jul 8, 1971	Hotel Corpn of India, Air India subsidiary formed.
Sep 9, 1971	Air-India Charters, subsidiary of Air India formed.
Jun 11, 1972	Daily 747 service to New York started.
Feb 15, 1979	A Sperry Univac 1100/22 Real Time Computer System installed.
Aug 12, 1982	Two Airbus join Air India fleet.
Sept 1984	Air India Amonas expansion of fleet.

Table 4 LANDMARKS - INDIAN AIRLINES

Landmarks in the History of Indian Airlines

1953 Aug	Air Corporation Act formation of Indian Airlines Corporation of Air India International 3 operational regions formed - Bombay Calcutta and Delhi.
1955	Night Air Mail Service introduced using DC4 aircraft.
1956/57	Viscounts introduced.
1961	Central Training Center established.
1963	Caravells introduced.
1964	Night Air Mail Services cancelled.
1965	Madras region was formed.
1969	Boeing 737 introduced.
1976	Air Bus (AB 300) introduced.
1981	Vayudoot - Indian Airlines subsidiary to serve SW/Northern states formed.
1984	Future expansion and intent to acquire Boeing 757s announced.

Table 5. GENERAL OVERVIEW - GLOSSARY

DISTANCE IN KILOMETRES: This is based on the great circle distance between airports.

AVAILABLE TONNE KILOMETRES (Atkm): Product obtained by multiplying the capacity in metric tonnes (1000 kg.) available for passengers, mail and cargo by the distance in kilometres flown by the Aircraft.

REVENUE TONNE KILOMETRES (Rtkm): Revenue earning load of passengers including excess baggage, mail and cargo in metric tonnes multiplied by the distance flown in kilometres.

OVERALL LOAD FACTOR: Ratio of revenue tonne kilometres to available tonne kilometres usually expressed as a percentage.

AVAILABLE SEAT KILOMETRES (Askms): Product obtained by multiplying the number of passengers by the distance in kilometres flown by them.

PASSENGER LOAD FACTOR. Ratio of revenue passenger kilometres to available seat kilometres usually expressed as a percentage.

RUPEE: Currency Unit of the Country. One U.S. dollar approximately equals 11 rupees.

LAKH AND CRORE: One lakh is equal to one hundred thousand, and one crore is equivalent to ten million.

Table 6. KEY PERSONNEL OF AIR INDIA

Board of Directors

Capt. A.M. KAPUR - Acting Chairman
Air Chief Marshall I.H. LATIF (Chief of Air Staff)
Field Marshal S.F. H.J. MANEKSHAW
B.D. PANDA (Industrialist)
S. RAMANATHAN (Chairman, IAAI)
Charanjit SINGH, M.P.
K.K. SRIVASTAVA
J.R.D. TATA (Industrialist)
I.B. VENKATARAMAN (Secretary, Ministry of Tourism & Civil Aviation)

Management

Capt. D. BOSE - Managing Director
Harsh VARDHAN - Executive Assistant to Chairman
V. RAMANATHAN - Executive Assistant to Managing Director
C.L. SHARMA - Deputy Managing Director
K.K. GADGIL - Director Ground Services
Capt. H.M. KAUL - Director Commercial
J.N. MOGRELIA - Director Finance
S.K. NANDA - Director Personnel & Industrial Relations
Capt. BHATIA - Director Operations
M.S. Bala SUBRAMANIAN - Director Engineering
S.K. DATTA - Deputy Director Planning
P. JAYANT - Deputy Director Management Services
N.A. TURNER - Deputy Director Inflight Services
P.G. BHANDARKAR - Controller Civil Works & Properties
G.D. DUBEY - Controller Communications
P.D. MARATHE - Controller Stores & Purchases

Table 7. KEY PERSONNEL OF INDIAN AIRLINES

Board of Directors

Capt. A.M. Kapur	Chairman
Capt. K. Chadha	Director
Air Chief L.M. Kmatre	Director
M.M. Kohli	Director
G.N. Mehra	Director
Prem Lal	Director

Executive Heads

Capt. K. Chadha	Managing Director
S.K. Sengupta	(Offg.) Director, Finance
Dharamvir	Director of Engineering
Capt. P.N. Reddy	Director of Operations
Capt. B.K. Bhasin	Director, Flight Safety
Capt. J.F. Ranji	Director of Training
R.K. Kanchan	Controller of Stores and Purchases
Wg. Cdr. N.C. Bharna, AVSM	Secretary

Regional Directors

Capt. V.K. Mehta	Western Region
Capt. R.K. Sen	Eastern Region
Capt. R.A. Williams	Southern Region

Table 8. FLIGHT EQUIPMENT AND FACILITIES FLEET-INDIAN AIRLINES

Type Aircraft	Average Seat First Coach	No. of Aircraft	Engine
A300B2-100	0/278	8	CF6-50C
A300B4-200	31/242	2	CF6-50
B737-200	0/126	25	JT8D-9/17
F-27-100	0/52e	6	DART 514-7
F-27-400	0/52e	1	DART 532
F-27-600	0/52e	1	DART 532-7
HS-748	0/62e	12	DART 531

e = Estimated

Table 9. FLIGHT EQUIPMENT AND FACILITIES FLEET AIR INDIA

Type	Name of the Aircraft	Registration Marking	Delivery Date	Engine	Configuration and Crew Complement	
1) 707-337C	Trishul	VT-DIT	22.8.1968	JT3D-3B7	Standard Configuration	Boeing 747 16 First Class (Slumberettes) 20 Club Class 358 Economy
2) 747-237B	Shahjehan	VT-EBE	4.5.1971	JT9D-777A/7Q	Operating Crew	Pilot, Co-pilot, Flight Engineer
3) 747-237B	Rajendra Chola	VT-EBW	1.4.1972	JT9D-777A/7Q	Cabin Crew	Inflight Supervisor, 17 cabin crew
4) 747-237B	Vikramaditya	VT-EBQ	7.6.1972	JT9D-777A/7Q	Standard Configuration	Airbus A300-B4-200 22 First Class, 216 Economy
5) 747-237B	Akbar	VT-EDU	27.12.1975	JT9D-777A/7Q	Operating Crew	Pilot, Co-pilot, Flight Engineer
6) 747-237B	Chandragupta	VT-EPJ	6.2.1978	JT9D-777A/7Q	Standard Configuration	Airbus A300-B4-200 22 First Class, 216 Economy
7) 747-237B	Kanishka	VT-EFO	2.7.1978	JT9D-777A/7Q	Operating Crew	Pilot, Co-pilot, Flight Engineer
8) 747-237B	Krishna Deva Raya	VT-EFU	14.8.1979	JT9D-777A/7Q	Cabin crew	Inflight Supervisor, 11 cabin crew
9) 747-237B	Samudragupta	VT-EGA	23.12.1979	JT9D-777A/7Q	Standard Configuration	Boeing 707 12 First Class, 132 Economy
10) 747-237B	Mahendra Varman	VT-EGB	22.2.1980	JT9D-777A/7Q	Operating Crew	Pilot, Co-pilot, Navigator, Flight Engineer
11) 747-237B	Harsha Vardhana	VT-EGC	4.4.1980	JT9D-777A/7Q	Cabin Crew	7 cabin crew
12) A300-B4	Ganga	VT-ENW	11.8.1982	CF6-50CZ	Standard Configuration	
13) A300-B4	Godavari	VT-ENQ	12.8.1982	CF6-50CZ	Operating Crew	
14) A300-B4	Cauvery	VT-ENQ	15.11.1982	CF6-50CZ	Operating Crew	

Table 10: Flight Equipment and Facilities

FLEET TECHNICAL DATA



BOEING 707 437



BOEING 707-337B/C



BOEING 747-237R



AIRBUS A300B4

AIR INDIA

WING SPAN	43:41 m	142 ft 5 in	44.43 m	145 ft 9 in	59.64 m	195 ft 8 in	44.84 m	147 ft 1 in
OVERALL LENGTH	46.41 m	152 ft 11 in	46.41 m	152 ft 11 in	70.51 m	231 ft 4 in	53.62 m	175 ft 11 in
OVERALL HEIGHT	12.71 m	41 ft 8½ in	12.95 m	42 ft 6 in	19.33 m	63 ft 5 in	16.92 m	55 ft 6 in
WIDTH OF FUSELAGE (OUTSIDE)	3.76 m	12 ft 4 in	3.76 m	12 ft 4 in	6.50 m	21 ft 4 in	5.64 m	18 ft 6 in
MAX TAXI GROSS WT	143337 kg	316000 lb	152407 kg	336000 lb	352895-364234 kg	778000-803000 lb	165900 kg	365740 lb
MAX LANDING WT	93894 kg	207000 lb	112037 kg	247000 lb	265351 kg	585000 lb	136000 kg	299820 lb
PAYLOAD	20000 kg	44092 lb	20000/19500 kg	44092/42990 lb	54000 kg	119048 lb	32000 kg	70547 lb
FUEL CAPACITY	80500 ltrs	17706 IG	90300 ltrs	19864 IG	193000 ltrs	42481 IG	62000 ltrs	13638 IG
AVERAGE FUEL CONSUMPTION (PER/HR)	8500 ltrs	1870 IG	7330 ltrs	1610 IG	13750 ltrs	3025 IG	7820 ltrs	1720 IG
NORMAL CRUISING SPEED	862 kmph	535 mph	862 kmph	535 mph	904 kmph	562 mph	851 kmph	528 mph

ENGINES

ROLLS ROYCE CONWAY P G W JT3D-3B G -7

P G W JT9D-7/-7J/-7Q

GE CF6-50C2

ENGINE THRUST	7950 kg	17500 lb	8170 kg	18000 lb	21320-24040 kg	47-53000 lb	23815 kg	52500 lb
RANGE (FULL PAX)	7000 km	4350 st miles	8500 km	5300 st miles	9100-9600 km	5750-6000 st miles	5500 km	3400 st miles
MAX CRUISE ALTITUDE (WITH CAPACITY PAYLOAD)	12800 m	42000 ft	12800 m	42000 ft	13700 m	45000 ft	12190 m	40000 ft
CARGO CAPACITY	6350 kg	14000 lb	6350 kg	14000 lb	15840 kg	34920 lb	9170 kg	20216 lb

Table 11. FLIGHT EQUIPMENT AND FACILITIES

<u>CARGO HANDLING EQUIPMENT</u>		
Item	Type	Manufacturer
Pallets & containers		Bruggemann & Brand, Brooks & Perkins
Pallet dollies & container	dollies	Bruggemann & Brand
Pallet/container conveyor restraint system		Brooks & Perkins
B.747 pallet & container loader	JCPL2	FMC
Pallet & container	800	Cochran Western
Transporter	5500	Cochran Western
Towing tractors		International Harvester, Secmafer S.A.
Nets, straps, fittings & racks		Bruggemann & Brand
B747 lower lobe pallet & container loader		FMC
B707 pallet handling equipment		FMC

<u>FLEET SUPPORT EQUIPMENT</u>		
Item	Type	Manufacturer
Baggage system	Cres-Flight	Mathews
Baggage tractors		Secmafer S.A.
Ground service equipment		Accessory Controls & Equipment
Passenger boarding stairs	Luna M	Dahms & Co.
Audio-visual equipment		Bell & Howell, Trans Com, International Systems
Aircraft jacking equipment	SKYHI	C.F. Taylor Ltd.

Table 12: Civilian Airports

(1 of 4)

2	Ref. Point: Lat. 283407N Long.:770648E Site: 305M (1000 ft.) Brg. 117deg. Geo. from intersection of Runways 09/27 and 15/33.	1	City/Aerodrome: DELHI/Delhi.
3	Distance and Direction from City: 8NM Brg 228 deg. Geo from Delhi Railway Station.	18	Fuel Grades: PF and TF - all grades.
4	Elevation : 227M (744 ft.)	19	Oil Grades: All grades of aviation oil and turbine oil.
5	Aerodrome Reference Temperature: 39.8°C (June)	20	Oxygen and Related Servicing: Nil
6	Magnetic Variation: 0° 11'E (1975)	21	Refuelling Facilities and Limitations: (a) H24 (b) No PN (c) Hydrant fuel and bowser.
7	Transition Altitude: 1050M (3500 ft.)	22	Hangar Space Available for Visiting A/cft: No Hangar accommodation is specifically reserved for visiting Aircraft.
8	Operational Hours: H24	23	Repair Facilities Normally Available: Available with local airlines operators.
9	Aerodrome Operator or Administrative Authority: International Airport Authority of India, New Delhi For Ats. Afm: Director General of Civil Aviation, and Nav. Aids: New Delhi.	24	Fire Protection: Water capacity required in foam Crash Fire Tender: 24000 ltrs. Water capacity available in foam Crash Fire Tender: 23640 ltrs.
10	Postal Address: Delhi Airport, New Delhi-110010	25	Seasonal Availability: Aerodrome serviceable during all seasons
11	Telegraphic Addresses: (AFTN) VIDPYD Commercial for DGCA Aerodrome, New Delhi For I. A. A. I.: Air Auth, Delhi.	26	Local Flying Restrictions: Avoid overflying Safdarjung Aerodrome Traffic Zone below 2500 ft (Alt) and maintain visual watch for light aircraft and Gliders in the vicinity.
12	Telephone Numbers: Director Delhi Airport: Office : 391126, 393481 Residence : 673836 Airport Manager's Office : 392729/393481 ATC : 392131 & 391681 Briefing : 392224 Controller of Aerodrome Office : 391932, 393461 Residence : 611559	27	Pre-flight Altimeter Check Point(s) and Elevation: (1) Not established. (2) End elevation of Runways: RWY 09 : 220M (722 ft.) RWY 27 : 229M (751 ft.) RWY 10 : 219M (719 ft.) RWY 28: 236M (774 ft.)
13	Overnight Accommodation: Hotels in city.		
14	Restaurant Accommodation: Restaurant, all types of meals served, provided at 150 meals per hour.		
15	Medical Facilities: First aid treatment and ambulance, hospital in Delhi cantt. - 3NM and in the city - 8NM.		
16	Transportation Available: Taxis.		
17	Cargo Handling Facilities: Available with local airlines operators.		

28

METEOROLOGICAL DATA

Mean Daily Maximum and Minimum Temperatures (C)

Temperature	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Maximum (a)	20.9	24.0	30.2	36.9	40.6	39.8	35.4	32.8	33.9	33.2	28.3	22.5
Minimum (b)	5.1	8.0	12.9	19.7	24.3	27.3	26.2	24.8	22.9	17.4	10.8	6.4

Monthly Mean Pressure in (MB) at approximately the times of maximum (a) and minimum (b) temperatures

Maximum (a)	988.0	985.8	983.0	978.4	973.9	970.1	970.8	972.1	976.5	982.0	986.7	988.2
Minimum (b)	990.3	988.2	985.6	981.6	977.6	973.6	972.8	974.7	979.4	984.9	989.0	990.6

Absolute Humidity (G/M³) at approximately the times of maximum (a) and minimum (b) temperatures

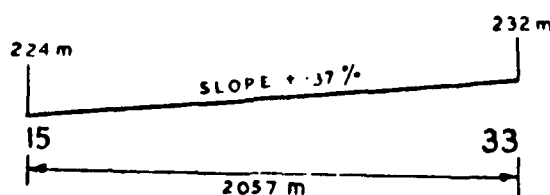
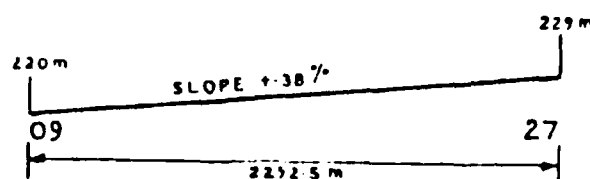
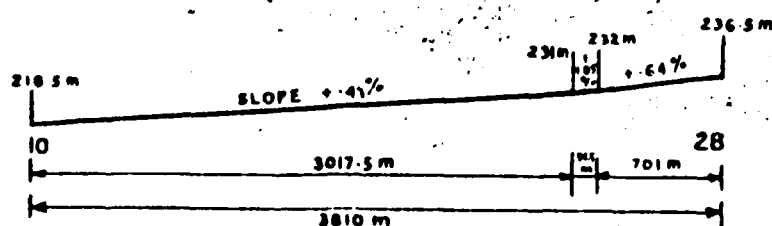
Maximum (a)	7.08	6.87	8.15	7.42	9.45	16.48	21.62	22.69	19.71	11.59	7.88	7.71
Minimum (b)	4.07	6.71	8.01	9.21	10.71	16.78	21.21	22.09	18.34	12.20	7.67	6.58

Table 12 cont'd: Civilian Airports

(2 of 4)

29

SLOPES: Longitudinal Profiles of Runways



30

PHYSICAL CHARACTERISTICS

Runway		Dimensions (M)				Usable Strength	Surface	
Designation	True Rtg.	Runway	Stopway	Clearway	Strip	Runway	Runway	Stopway
a	b	c	d	e	f	g	h	i
10 28	104 284	3810M x 46M 12500 ft x 150ft	-	Nil 61M x 305M 200 ft x 1000ft	3932M x 305M 12900 ft x 1000 ft	LCN95	Asphalt concrete	
09 27	090 270	2292.5M x 46M 7520ft x 150ft	-	-	2414M x 152M 7912ft x 500ft.	LCN40	Asphalt with cement con- crete ends	
15 33	150 330	2057M x 46M 6750ft x 150ft.	-	-	2179.5M x 152M 7150ft x 500 ft.		Asphalt	

- Remarks:**
- (1) RWY 15/33 available for overnight parking only.
 - (2) Landing distance available. RWY 28-3505M (11500 ft) ; RWY 10-3658M (12000 ft); RWY 27-2155M (7070 ft.)
 - (3) RWY 09/27 open for operation during day and for taxiing only via Delta taxi track during night.
 - (4) THR of RWY 10 permanently displaced by 500 ft from beginning of RWY.
 - (5) Adjacent domestic Aerodrome Safdarjung Rwy 30/12 Distance 4.9NM bearing 069 Deg. from Delhi Airport.

Table 12 cont'd: Civilian Airports

(3 of 4)

31	Movement Areas						
<p>Aprons: 1. 198M x 97.5M (650 ft. x 320 ft.) 2. 97.5M x 116M (320 ft. x 380 ft.) 3. 219.5M x 122M (720 ft. x 400 ft.) 4. 45.5M x 45.5M (150 ft. x 150 ft.) 5. 129.5M x 70M (425 ft. x 230 ft.) 6. 131M x 137M (430 ft. x 450 ft.) 7. 274M x 122M (900 ft. x 400 ft.) Surface : Tarmacadam/Concrete</p> <p>Taxiways: Width 23M (75 ft.) Designation : A, B, C, D, E, F & G Surface : Tarmacadam.</p> <p>: Due to limited apron space non-scheduled international flights are restricted to day light hours only. However, in exceptional circumstances permission for arrivals/departures during night, will be given by Director General of Civil Aviation.</p> <p>Note: Delhi Airport closed between 1430-0230 GMT daily for non-scheduled international flights due shortage of parking space.</p>							
Helicopter Alighting Areas: Not established.							
VISUAL GROUND AIDS							
32	Taxying Guidance Systems: Taxying guidance given on R/T.						
33	Visual Aids to Location: ABN Flg W & G: Identification Sign						
34	Indicators and Ground Signalling Devices: LDI, WDI-Lgtd; Signal area-Not Lgtd						
35	Lighting Aids:						
<p>Approach Lighting: RWY-10 Simple approach lights RWY-28 Precision approach lights. RWY-09 Not operational. RWY-27 Simple Approach light.</p> <p>Runway Lighting: RWY 10 } Edge, Threshold and End lights (High intensity) RWY 28 } RWY 09 } Edge, Threshold and End lights (Medium intensity) RWY 27 }</p> <p>VASIS : Rwy 10: Glide angle 2 75 deg setting & variable intensity.</p> <p>Other Lighting: Taxiway Edge Lights-all Taxiways. Apron lights</p>							
36	Emergency Lighting: For RWY 10/28 and 09/27 Location or characteristics-as required by Annex 14, Part V, Chapter I. Secondary power supply conforms fully with the requirements of Annex 14, Part IV, Chapter I for category I operations.		37	Obstruction Marking and Lighting: All operationally significant obstructions marked and lighted			
38	Marking Aids: Threshold, touch down, designation numbers, centre line, side strips & fixed distance markings - all runways Taxi Holding - Taxiway Centre line : All Taxiways						
Obstructions in Approach and Take off Areas							
Rwy	Type	Elev (M)	From Rwy Threshold Dist (M) Mag	Rwy	Type	Elev (M)	From Rwy Threshold Dist (M) Mag
a	b	c	d e	a	b	c	d e
This information is depicted on Aerodrome Obstruction Charts-ICAO (Type A)							
Remarks:							
Declared Distances:		RWY	TORA	ASDA	TODA	LDA	
		M	M	M	M	M	
		10	3810	3810	3810	3658	
		28	3810	3810	3871	3505	

Table 12 cont'd: Civilian Airports

(4 of 4)

DELHI, INDIA

DELHI INTL

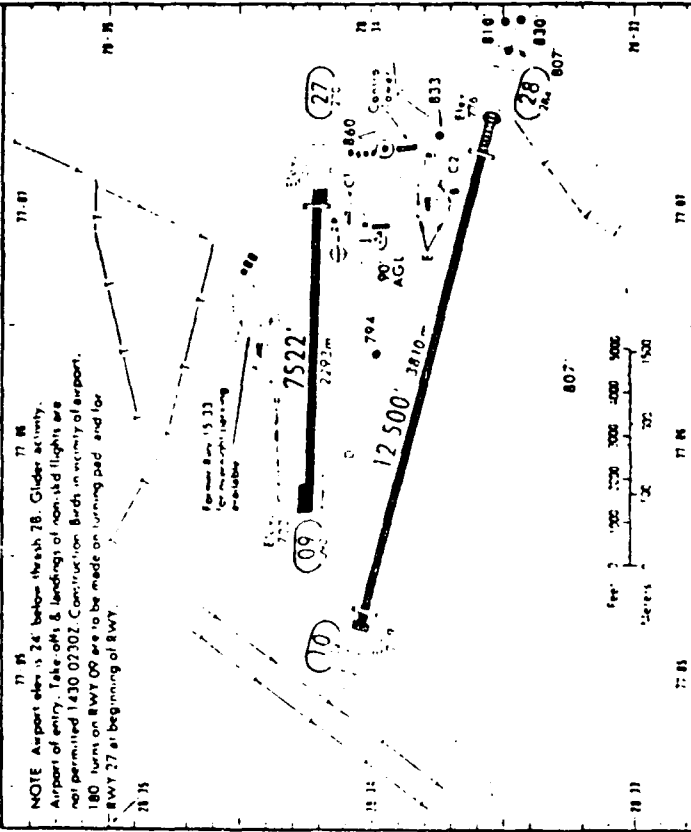
N 78 34.1 E 077 06.8

Elev 744' V 4.0'

DELTA Ground 121.9

Tower 118.1

NOTE: Airport elev is 24' below threshold 78. Glider activity. Airport of entry. Take-offs & landings of non-ATIS flights are not permitted 1430-0730Z. Construction birds in vicinity of airport. 180° turn on RWY 09 are to be made on turning pad and for RWY 27 at beginning of RWY.



ADDITIONAL RUNWAY INFORMATION			
RWY	LANDING BEYOND	USEABLE LENGTHS	
		In-stroke	Take Off
09	MIRL VASI	150	150
27	MIRL ALS VASI	7018'	2139'
10	MIRL CL MIALS VASI (3bar)	RVR 12,000'	3450'
28	MIRL CL MIALS TOZ VASI (3bar)	RVR 11,500'	3505'
		10,500'	3700'

NOTE: Runway 10-28 runway lights are installed 26' (8m) outside of runway edge.

TAKE OFF				FOR FILING AS ALTERNATE			
AIR CARRIER		AIR CARRIER (FAR 121)					
RWY 10-28		RWY 09/27		All Runways			
Width CL		Width CL					
A	150m	200m	200m	1			
B	200m	300m	300m	2m			
C				3 & 4			
D	250m	400m	400m	5m			
				see 460m x 100m			

DELHI, INDIA

DELHI INTL

N 78 34.1 E 077 06.8

Elev 744' V 4.0'

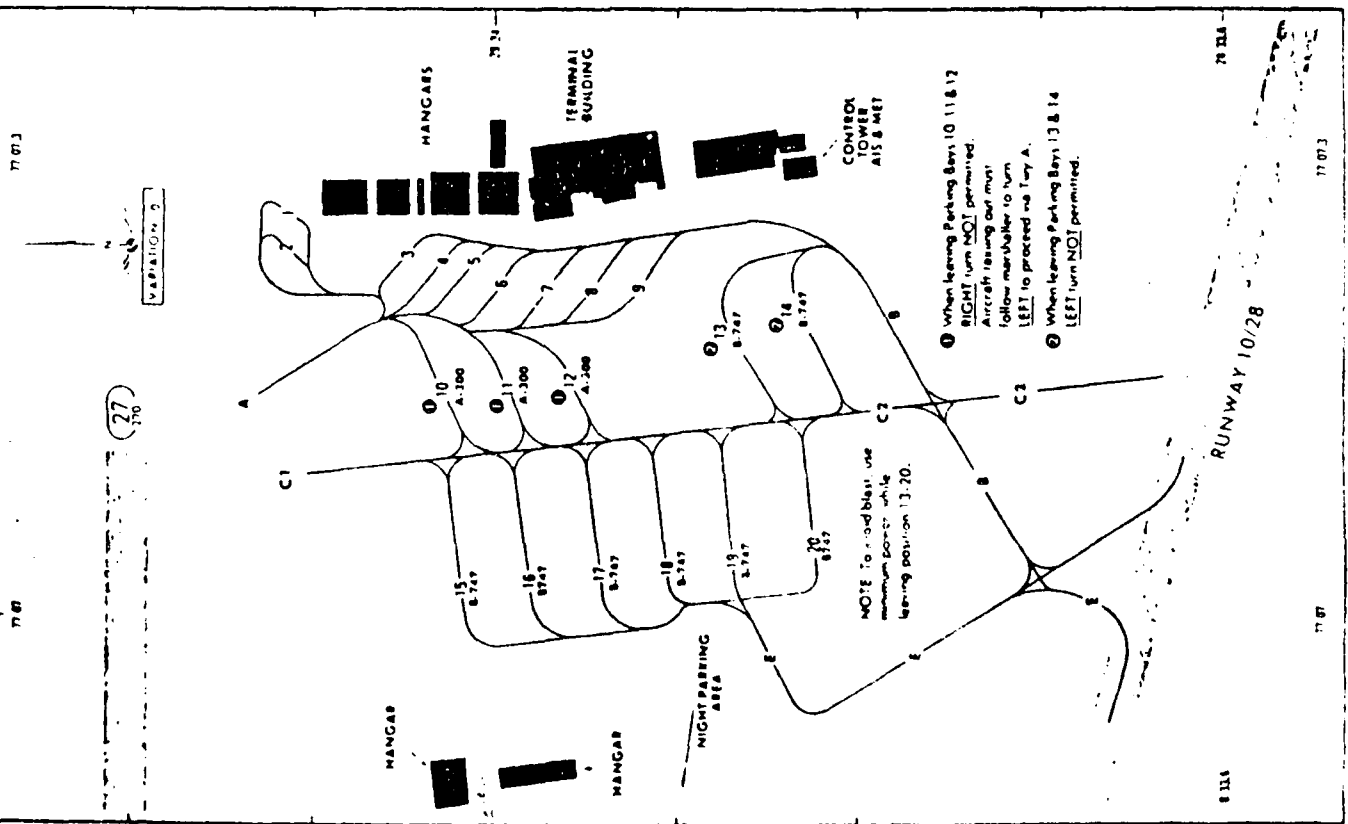


Table 13: Civilian Airports

(1 of 4)

2	Ref. Point : Lat. 10°45'51"N Long. 78°42'58"E Site : 658m. Bearing 090° Geo from Intersection of Rwy 09/27 and 15/33	1	City/Aerodrome : TIRUCHCHIRAPPALLI/ Tiruchchirappalli									
3	Distance and Direction from City : 2.6 NM Bearing 135° Geo from Tiruchchirappalli Railway Station.	17	Cargo Handling Facilities : By respective Airlines. Manual.									
4	Elevation : 85 m.	18	Fuel Grades: PF 100/130 at a time 1800 ltr. TF K-50 at a time 8500 ltr.									
5	Aerodrome Reference Temperature: 37.1°C (May)	19	Oil Grades : NIL									
6	Magnetic Variation : 2°37'W (1975)	20	Oxygen and Related Servicing : NIL									
7	Transition Altitude : 1200 m (4000 ft.)	21	Refuelling Facilities and Limitation : (a) 1400 to 0630 Hrs. GMT daily. (b) 3 hours PN required during Day time. (c) Bowsers.									
8	Operational Hours : HO	22	Hangar Space Available for Visiting ACFT: NIL									
9	Aerodrome Operator or Administratives Authority : Director General of Civil Aviation, New Delhi. Pin Code: 110 022.	23	Repair Facilities Normally Available: NIL									
10	Postal Address : Civil Aerodrome, Tiruchchirappalli, Pin Code: 620 007.	24	Fire Protection : Required: Category III Available: Category II Trained Personnel: 11 Facilities available for foaming of Runways: III									
11	Telegraphic Addresses : (AEROD) : MOTRYD (Commercial): Aerodrome Tiruchchirappalli	25	Seasonal Availability : Aerodrome generally remains serviceable during all seasons.									
12	Telephone Numbers : ATC: 25361/28 and 25146 Aerodrome Officer Res) 25176 (Office) 25361/29	26	Local Flying Restrictions : Pilots are warned of the presence of vultures and kites near the Aerodrome, especially over Tannery situated nearby and are advised to exercise caution while using this Aerodrome.									
13	Overnight Accommodation: NIL at Aerodrome. Limited accommodation is available in the City Hotels.	27	Pre-Flight Altimeter Check Location(s) and Elevations : Established at the junction of Taxiways and Apron. Elevation 85 m.									
14	Restaurant Accommodation : Light refresh- ments. Limited meals available with prior arrangements with Restaurants.											
15	Medical Facilities : First Aid Treatment and Ambulance. Hospital in city 5 NM.											
16	Transportation Available : Nil at Aerodrome. Taxis available in the City.											
28 METEOROLOGICAL DATA												
Mean Daily Maximum and Minimum Temperatures (C)												
Temperature	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Maximum (a)	30.1	32.7	35.1	36.7	37.1	36.4	35.5	35.1	34.2	32.3	29.9	29.3
Minimum (b)	20.6	21.3	22.9	25.8	26.4	26.5	25.9	25.4	24.9	23.9	22.7	21.3
Monthly Mean Pressure in (MB) at approximately the times of maximum (a) and minimum (b) temperatures												
Maximum (a)	1000.7	999.4	997.5	995.2	992.8	993.0	993.7	994.1	994.4	996.6	998.8	1000.3
Minimum (b)	1004.7	1003.8	1002.2	1000.2	997.2	996.7	997.2	997.7	998.8	1000.5	1002.3	1004.0
Absolute Humidity (G/M ³) at approximately the times of maximum (a) and minimum (b) temperatures												
Maximum (a)	15.10	13.92	14.12	16.36	16.56	16.15	15.48	16.66	17.41	19.02	18.13	16.92
Minimum (b)	16.81	17.56	19.35	20.98	20.11	17.43	17.34	17.98	18.63	20.01	19.19	17.19

Table 13 cont'd: Civilian Airports

(2 of 4)

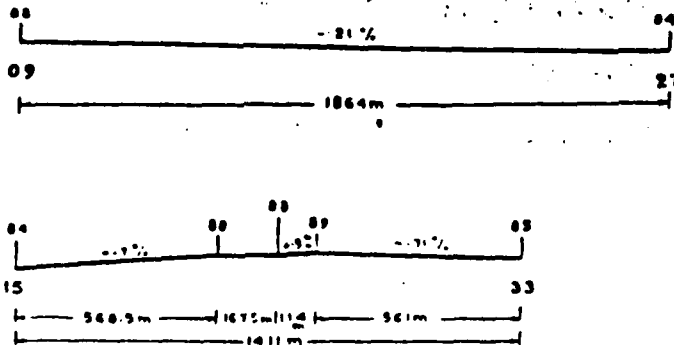
29	SLOPES: LONGITUDINAL PROFILES OF RUNWAYS STOPWAYS AND CLEARWAYS:								
									
30	PHYSICAL CHARACTERISTICS								
Runway		Dimensions (M)				Strength	Surface		
Designation	True BRG.	Runway	Stop-way	Clearway	Strip	Runway	Runway	Stop-way	
a	b	c	d	e	f	g	h	i	
09	086°	1864m x 46m.	-	152m x 152 m.	1986m x 152m.	LCN-30	Concrete	-	
27	266°		-	128m x 152 m.				-	
15	149°	1411m x 46m.	-	168m x 152 m.	1533m x 152m.		Concrete	-	
33	320°		-	265m x 152m.				-	
<u>Remarks:</u> 1) Rwy 15/33 at Civil Aerodrome, Tiruchchirappalli has been closed for aircraft operations WEF 28th July 1978 UFN. 2) The side strip of Rwy 15/33 is not useable.									
31	MOVEMENT AREAS								
Aprons : 137 m x 91m.					Taxiways: Width 15m.				
Surface : Concrete					Surface : Concrete				
Helicopter Alighting Areas : Not established.									

Table 13 cont'd: Civilian Airports

(3 of 4)

VISUAL GROUND AIDS									
32	Taxying Guidance Systems: Taxying guidance given on R/T.								
33	Visual Aids to Location: ABN FLG W & G IDENTIFICATION SIGN.								
34	Indications and Ground Signalling Devices: LDI - Lighted WDI) Signal Area) Unlighted								
35	Lighting Aids								
Approach Lighting: Simple Approach Lights on Rwy 27 - High Intensity.					Runway Lighting: Rwy 09/27 EDGE, THRESHOLD and END Lights - Medium Intensity - Green. Taxiway Lights: Available. Other Lights: Apron Flood Lights - Aerodrome Beacon				
36	Emergency Lighting and Secondary Power Supply: Paraffin Flares. Secondary Power Supply available. Maximum switch over time 3 minutes.				37	Obstruction Marking and Lighting: All operationally significant. Obstructions are Lighted and marked.			
38	Marking Aids: Designation Numbers - THRESHOLD - CENTRE LINE - Provided on all Rwys. Taxi Holding Position - Taxiway Centre Line: All Taxiways.								
39	OBSTRUCTIONS IN APPROACH AND TAKE-OFF AREAS								
	RWY	TYPE	ELEV (M)	FROM RWY THRESHOLD		RWY	TYPE	ELEV (M)	FROM RWY THRESHOLD
				DIST (M)	MAG				DIST (M) MAG
	a	b	c	d	e	a	b	c	d e
(This information is depicted in Aerodrome Obstruction Chart - ICAO (TYPE-A))									
REMARKS:									
Declared Distances:		RWY	TORA M	ASDA M	TODA M	LDA M	40		
		09	1864	1864	2016	1699	NIL		
		27	1864	1864	1864	1864			
41	DISABLED AIRCRAFT REMOVAL: CAPACITY: Limited - Manual Labour only.								

Table 13 cont'd: Civilian Airports

TIRUCHCHIRAPPALLI, INDIA

TIRUCHCHIRAPPALLI

VOTR

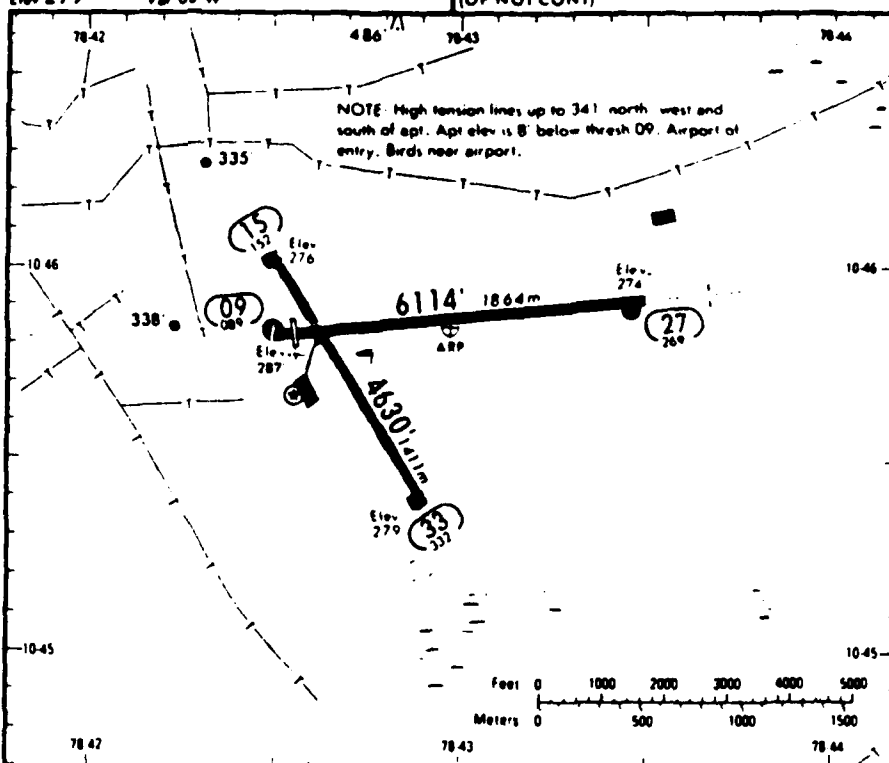
N10 45.9 E078 43.0

Elev 279'

Var 03 W

TRICHY Tower 118.3

(OP NOT CONT)



ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS			WIDTH
		LANDING BEYOND Threshold / Glide Slope		TAKE-OFF	
09	MIRL	5374'	1649 m		150 46 m
27	MIRL HIALS				
15	Temporarily closed				150 46 m
33					

TAKE OFF

AIR CARRIER		FOR FILING AS ALTERNATE	
A B C D	All Rwy's	A B C D	Non-Precision
	200m		800
	300m		3200 m
	400m		

Table 14. PERSONNEL STATISTICS BY AIRLINE

Rate of Exch 1 Indian Rupee = 0.103550\$

Air India:

Category of Staff	Number of Personnel	Average Annual Salary (US\$)	Total Expense in US\$
Pilots/Co-pilots	277	12,238	3,389,942
Other Cockpit Personnel	185	10,700	1,979,500
Cabin Attendants	2,612	2,725	7,117,700
Maintenance/Overhaul Personnel	6,007	3,295	19,798,065
Ticket Sales & Promotional Personnel	4,875	7,934	38,678,250
Other Personnel	<u>3,518</u>	<u>4,611</u>	<u>16,221,498</u>
TOTALS	17,474		87,179,259

Indian Airlines:

Category of Staff	Number of Personnel	Average Annual Salary (US\$)	Total Expense in US\$
Pilots/Co-pilots	468		
Other Cockpit Personnel	49		
Cabin Attendants	869		Data Not Available
Maintenance/Overhaul Personnel	5,015		
Ticketing/Sale/Prom tional Personnel	4,882		
Other Personnel	<u>7,487</u>		
TOTAL	18,781		

Reference: Air Transport World, May 1984.

Table 15. COMMUNICATIONS SYSTEMS - INFLIGHT COMMUNICATIONS

FLEET AVIONICS

(By aircraft
type)

Item	Type	Manufacturer
<u>Boeing 707/737</u>		
Autopilot		Sperry Flight Systems
Flight director	Z-5/HZ-4	Sperry Flight Systems
Airspeed indicators		Smiths Industries
ADI systems		SFENA
GPWS		Sundstrand Data Control
Flight data recorder	109C	Lockheed
Cockpit voice recorder	V-557	Sundstrand Data Control
<u>Boeing 747</u>		
Autopilot	SPZ-1	Sperry Flight Systems
Flight director	SPZ-1	Sperry Flight Systems
INS	Carousel	Delco Electronics
Compass	FV-901	Sperry Flight Systems
GPWS		Sundstrand Data Control
Flight data recorder	ARINC 743	Sundstrand Data Control
	Efdars	
Cockpit voice recorder	V-557	Sundstrand Data Control
<u>Air Bus</u>		
Autopilot		Sena of France
Flt. Director		Sperry Flight Systems
Air Speed Indicator		Sena
ADI System		SFENA
GPWS		Sundstrand Data Control
Flight Data Recorder		Fairchild/Sundstrand Data Control
INS		Litton/Delco/Honeywell
ILS Receiver		Benedix/Collins
Cockpit Voice Recorder		Sundstrand Data Control/Lockheed
<u>HS 748</u>		
Twin VHF Communications		Collins
Twin ADF		Collins
Weather Radar		Benedix
DME		Collins
ATC Transponder		Collins
PA & Entertainment		Field Tech. Helicom
Radio Navigation with Dual Compass		Sperry Flt. System
Autopilot		Sperry Flt. System
Flight Data Recorder		Fairchild
Cockpit Voice Recorder		Sundstrand

Table 15. COMMUNICATION SYSTEMS - INFLIGHT COMMUNICATIONS (CONTINUED)

Fokker F-27

- Weather radar
- Autopilot
- HF communication system
- BHF communication system, dual
- VHF navigation system, dual
- Marker beacon system
- ADF system, dual
- Dual gyrosyn compass sytem
- Intercommunication system
- Public address system
- ATC-transponder

Optional Equipment:

- Radio altimeter
 - DME
 - Flight director
 - INS
 - VLF/Omega
 - Military avionics
 - Other equipment
-

Table 16: Communication Systems – Indian Airlines

(1 of 2)

ALPHABETICAL LIST OF NAVIGATION AIDS BY IDENTIFICATION					
ID	STATION	FACILITY	ID	STATION	FACILITY
1	2	3	1	2	3
AAE	Ahmedabad	VOR/DME	CEA	Calcutta	VOR/DME
AE	Ahmedabad	NDB	CG	Chandigarh	NDB
AG	Agra (IAF)	NDB	CN	Carnicobar (IAF)	NDB
AL	Aligarh	NDB	CZ	Bombay	LM
AR	Amritsar	NDB	DBR	Dibrugarh	NDB
AS	Madras	LM	DB	Dhanbad	NDB
AU	Aurangabad	NDB	DG	Dandigul	NDB
AAU	Aurangabad	VOR	DH	Delhi	NDB
EB	Bombay	NDB	DLI	Delhi	TVOR
EPB	Bombay	VOR/DME	DP	Delhi	NDB
PEM	Belgaum	VOR	DPA	Delhi	VOR/DME
PEW	Varanasi	VOR/DME	DPN	Delhi	VOR/DME
EBS	Bhubaneshwar	VOR	DR	Dadri	NDB
EC	Perachampa	NDB	DU	Calcutta	LO
EG	Bangalore	NDB	DUM	Calcutta	ILS/LLZ
EE	Fellary	NDB	DUM	Calcutta	GP/DME
EF	Phul	NDB	EA	Calcutta	NDB
EM	Belgaum	NDB	FB	Farukhabad	NDB
ENB	Bombay	L	GB	Gulbarga	NDB
EN	Varanasi	NDB	GC	Gaya	NDB
ENR	Bhunar	NDB	GGC	Gaya	VOR/DME
EP	Bhopal	NDB	GGT	Gauhati	VOR
EPL	Bhopal	VOR	GHT	Gauhati	ILS/LLZ
BS	Bhubaneshwar	NDB	GH	Gauhati	LO
BT	Hyderabad (Civil & IAF)	NDB	GR	Nagpur	L
BV	Bhaunagar	NDB	GT	Gauhati	NDB
BVR	Bhaunagar	VOR	HT	Gauhati	LM
BZ	Vijaywada	NDB	HHY	Hyderabad (Civil & IAF)	VOR/DME
CB	Coimbatore	NDB	HR	Hissar	NDB
CC	Cochin (Civil & Navy)	NDB	HW	Nainital (Pantnagar)	NDB
CCB	Coimbatore	VOR	HY	Hyderabad (Civil & IAF)	L
			ID	Indore	NDB
			IM	Imphal	NDB
			IIM	Imphal	TVOR
			JH	Jharsuguda	NDB
			JJO	Jodhpur (Civil & IAF)	VOR
			JJP	Jaipur	VOR/DME
			JMR	Jamnagar (Civil & IAF)	NDB
			JO	Jorhpur (Civil & IAF)	NDB

Table 16 cont'd: Communication Systems -- Indian Airlines

(2 of 2)

ALPHABETICAL LIST OF NAVIGATION AIDS BY IDENTIFICATION					
ID	STATION	FACILITY	ID	STATION	FACILITY
1	2	3	1	2	3
JP	Jaipur	NDB	PO	Pune (Poona) IAF	NDB
JS	Jamshedpur	NDB	PR	Porbandar	NDB
KH	Katihar	NDB	PPB	Port Blair	VOR/DME
KKU	Silchar	VOR	PT	Patna	NDB
KL	Akola	NDB	QZ	Vadodara	NDB
KS	Keshud	NDB	RC	Ranchi	NDB
KU	Silchar	NDB	RK	Rajkot	NDB
LK	Lucknow	NDB	RP	Raipur	NDB
LLK	Lucknow	VOR/DME	RRK	Rourkela	NDB
LM	Delhi	LM	SA	Sihora	NDB
MIA	Madras	LO	SB	Sikandrabad	NDB
MIAS	Madras	ILS/LLZ	SCZ	Bombay	ILS/LLZ
MIAS	Madras	GP/DME	SCZ	Bombay	GP/DME
MD	Madurai	NDB	SC	Bombay	LO
MDI	Madurai	VOR	SG	Songadh	NDB
MFR	Muzaffarpur	NDB	SNG	Srinagar	NDB
MG	Magadi	NDB	SNG	Srinagar	VOR/DME
ML	Mangalore	NDB	TK	Tarakeshwar	NDB
MMS	Mandasor	VOR	TP	Tirupati	NDB
MMV	Madras	VOR/DME	TTR	Tiruchchirappalli	VOR
MS	Mandasor	NDB	TR	Tiruchchirappalli	NDB
MV	Madras	NDB	TV	Trivandrum	NDB
NNP	Nagpur	VOR/DME	TVM	Trivandrum	VOR/DME
NP	Nagpur	NDB	UD	Udaipur	NDB
NR	Lilabari	NDB	UM	Calcutta	LM
NUH	Nuh	NDB	VB	Vikrabad	NDB
PB	Port Blair	NDB	VZ	Vishakhapatnam	NDB
PBR	Port Blair	L	WSM	Washim	VOR
PL	Delhi	LO	YD	Hyderabad	L
PLM	Delhi	ILS/LLZ			
PH	Panagarh	NDB			
PK	Pathankot	NDB			

Table 17. COMMUNICATION SYSTEMS GLOSSARY

DME	-	Distance Measuring Equipment
GP	-	Glide Path
ILS	-	Instrument Landing System
L	-	Locator
LLZ	-	Localizer
LM	-	Locator Middle Marker
LO	-	Locator Outer Marker
NDB	-	Non Directional Beacon
TVOR	-	Terminal Very High Frequency Omni Directional Range Station
VOR	-	Very High Frequency Omni Directional Range Station

Table 18. MAINTENANCE FACILITIES - MAINTENANCE EQUIPMENT OF AIR INDIA AT BOMBAY

Item	Type	Manufacturer
Horizontal balancing machine for JT9D engines	RL50UB	Schenck Trebel
Vertical balancing machine for JT9D engines	ZE40	Schenck Trebel
Horizontal balancing machine	R54/56UnB	Schenck Trebel
Horizontal balancing machine	RL2B/6	Schenck Trebel
Vertical balancing machine for RR Conway, JT3D engines	Z44E	Schenck Trebel
Ground support & test equipment		BLH Electronics
Ground service equipment		Aviquipco

Table 19: Maintenance Schedules

Indian Airlines

THE FOLLOWING INSPECTION SCHEDULES ARE APPROVED FOR AIRBUS A 300 AIRCRAFT

To be carried out before departure of each flight at all Stations including the main base station by persons appropriately licensed/Approved by DGCA or by persons appropriately approved by IA in categories 'Airframe, Engine' unless any other higher schedule, incorporating all items of Transit Check has been accomplished.

To be carried out by persons appropriately licensed/Approved by DGCA or persons appropriately approved by IA in categories 'Airframe, Engine' and 'Communication and Navigation' prior to departure of the aircraft from main base or outstation(s) at intervals not exceeding 40 hours elapsed time whichever is earlier, since last such inspection or higher inspection incorporating all items of Check 'A' inspection schedule has been accomplished.

However, if a 'Check 'A' inspection falls due, on any aircraft diverted to a station, for reasons other than due to mechanical defects, the aircraft may be released for flight from that station after accomplishment of approved Transit Check inspection provided prior permission for release of the aircraft is obtained from (FIM/EM (O)) of the base station of the aircraft. For the purpose of this provision an appropriately licensed Flight Engineer having approval to this effect will be deemed to be our approved person to accomplish Transit Check inspection. However, an approved Ch A Ch B Schedule has to be carried out and certified by appropriately licensed AMIs. Approved persons at the first opportunity while carrying out Ch A, radio items can be deferred upto a maximum time limit of 40 hours E.T. provided necessary entry is made in DMR of this book.

This inspection will be done 'weekly' unless a higher inspection is done. This check will have Not to exceed time limit of 75 FH/7 days E.T., whichever is earlier.

1) This inspection is to be carried out by appropriately licensed AMEs(s) and ARME(s) or DGCA approved person(s) in Cat. A/F. Engines, Instruments & Auto Pilot, Electrical, Communication and Navigation at every 300 Flying hours/60 days elapsed time, whichever comes earlier, since last such inspection or higher inspection incorporating all items of 'Check 'C' inspection schedule A "CERTIFICATE OF FLIGHT RELEASE" shall be issued after completion of this inspection by a Key person based on the certificate of Maintenance signed by Approved person in the above mentioned five categories.

The "CERTIFICATE OF FLIGHT RELEASE" shall remain normally valid for a period of 300 Flying hours or 60 days elapsed time whichever comes earlier. In case a check 'I' inspection falls due earlier, during the above normal validity period of 300 FH/60 days of elapsed time, the validity of such "FLIGHT RELEASE CERTIFICATE" shall be limited accordingly, so as not to exceed the Check 'I' period in terms of 111 or elapsed time (i.e. 600 FH/120 days).

2) This inspection is divided into two parts, Part I and Part II. Part I of this check (which also includes the items of Check 'B' inspection) is to be certified on completion of all the items called for in this part.

Part II of this check consists of 'Pre-flight checks which are to be carried out and certified prior to release of the aircraft for flight. However, if a per-flight Check (Part II of 'Check 'C' Inspection) has been completed and certified and the aircraft does not depart within 4 hours following such certification, another pre-flight check (Part II of 'Check 'C' Inspection) shall be carried out and certified prior to release of aircraft for further flight. Part II is to be certified by person approved in Cat. A/F & Engines.

1) This inspection is to be carried out by appropriately licensed AME (s) and ARME (s) or DGCA approved persons in Cat. A/F. Engines, Instruments & Auto Pilot, Electrical, Communication & Navigation at every 600 Flying hours/120 days elapsed time whichever comes earlier since last such inspection and a "CERTIFICATE OF FLIGHT RELEASE" shall be issued after completion of this inspection by a key person based on the certificate of Maintenance signed by approved persons in the above mentioned five categories.

2) The CERTIFICATE OF FLIGHT RELEASE shall remain valid for a period of 300 Flying hour or 60 days elapsed time, whichever comes earlier.

3) This Check is divided into two parts, Part I and Part II. Part I of this Check includes all items of Check 'B' and Check 'C' inspection and additional area inspection as well as systems test with higher standard, rectification of snags and 'open' items (i.e. deferred maintenance items). A certificate of Flight Release is issued after completion of this (Part I) inspection. Part II of this Check covers the pre-flight check to be performed prior to departure of aircraft for flight, and is to be certified by approved persons in A/F and Engines.

If a pre-flight Check (Part II of Check 'I' inspection) has been completed and the aircraft, and the aircraft does not depart within four hours following such certification, another pre-flight Check shall be carried out and certified prior to release of aircraft for flight.

Is a 3000 Flying hours inspection. To be accompanied by "Certificate of Flight Release" Inspection

TRANSIT CHECK

CHECK 'A' (Daily Check)

CHECK 'B' (Weekly Check)

CHECK 'C' (Certificate of Flight Release inspection)

Check I (Certificate of Flight Release inspection)

Check II

Table 20: Maintenance Schedules

THE FOLLOWING SCHEDULES ARE APPROVED FOR BOEING 737 AIRCRAFT

CHECK 'A'

To be accomplished on aircraft and engines prior to each flight from Base or outstation unless any other higher schedule incorporating all items of Check 'A' schedule has been accomplished.

CHECK 'B'

To be carried out at intervals not exceeding 24 hours flying time or 48 hours elapsed time whichever occurs earlier since accomplishment of the preceding Check 'B' or any other higher schedule of inspection incorporating all items of check 'B' inspection schedule. If a check 'B' fails due on any aircraft diverted to a station for reasons other than due to mechanical defects, the aircraft may be released for flight from that station after accomplishment of approved Check 'A' inspection, or after accomplishment of specific additional items of inspection approved for the purpose and included in the Pilot's check lists, by a Pilot duly trained as per D.G.C.A. requirements. The time and date for calculation purpose of elapsed time in Hours/Days will be on the basis of timings reflected in the Check 'B' schedule by AMEs in category 'A' and 'C' who finally clears the schedule.

FLIGHT RELEASE
CHECK 'C'

The Flight Release certificate is valid upto 2400 hrs from the date preceding the completion of 480 Flight Hours/70 days elapsed time whichever is earlier from the date

CHECK I

Will be carried out every 1350 Flying hours. On completion, a new Flight Release Certificate will be issued, and a check 'B' inspection carried out prior to release, provided higher check validity is not exceeded.

CHECK II

Will be a 16200 F. Hrs. inspection, split into 4 equalized parts, Check II Part 'A' Check II part 'B', Check II Part 'C', Check II Part 'D', to be done within of 4050 F. hours, completing the cycle in 16200 F. hours. Time interval between 2 identical parts of Check II will not exceed 16200 hours, subject to an elapsed time limitation of 6 years.

Table 21: Maintenance Schedules

THE FOLLOWING SCHEDULES ARE APPROVED FOR HS-748 AIRCRAFT

TRANSIT 'A'	—	To be carried out before each flight (except for Training flight in which case Tr. 'A' will be done before the first Training flight of the day and thereafter, when the interval between the termination of one Training Flight and the commencement of the next one is more than 2 hours)
TRANSIT 'B'	—	1. To be carried out on completion of 20 Flying Hrs. or 48 Elapsed Hrs. whichever is earlier since last Tr. 'B' inspection.
CHECK-1 (FLIGHT RELEASE)	—	2. After every Check-1 and each part of Check-II i. e. Ch. II Part A, Ch. II Part B, Ch. II Part C & Ch. II Part D.
		1. To be carried out at every 400 hours or 75 days from the date and time of issue of Flight Release whichever occurs earlier. On completion of Ch. I inspection, a new Flight Release will be issued duly signed by appropriately licenced AME / A.R.M.E. / APP. INSP.
		2. After each Part of Check II, i. e. Ch. II Part A, Ch. II Part B, Ch. II Part C, and Ch. II Part D.
INTERMEDIATE INSPECTION	—	To be carried out at 1200 Hrs. along with III Ch. I after last Ch. II inspection (any part)
CHECK II	—	Is a 8000 hours Inspection split into 4 parts, Check II Part A, Check II Part B, Check II Part C & Check II Part D, to be done at an interval of 2000 hours each, completing the cycle in 8000 hours.

Table 22. MAINTENANCE FACILITIES - INDIAN AIRLINE EQUIPMENT CONDITION

Type	A 300 B2 and B4 ENG. CF6-50	B-737 ENG. JT-8D-9A JT-8D-17	HS 748 R.R. 533-2
Age	8 yrs.	14 yrs.	18 yrs.
Location (1984)	Bombay 4 Calcutta 1 Delhi 2 Madras 1 Operating 8 Eng/Maint 2 Fleet 10	Bombay 5 Calcutta 4 Delhi 9 Madras 4 Hyderabad 1 Operating 23 Eng/Maint 2 Fleet 25	Bombay 2 Calcutta Nil Madras 1 Hyderabad 2 Operating 5 Eng/Maint 2 Fleet 7
	Maintenance Base at Bombay	Maintenance Base at Delhi	Maintenance Base at Hyderabad
Spares (1983) [Net stores inventory holding for Active Fleet]	Rupees in Crores 37.75	Rupees in Crores 22.59	Rupees in Crores 4.82
Spares [Ratio of stores holding to Aircraft Fleet (%)]	12.1%	10.5%	36.5%
Maintenance Effectiveness [Engineering performance (%)]	Western Region 98.3% Eastern Region 98.4% Northern Region 99.6% Southern Region 98.9%		

Based on Rate of
1 Indian Rupee = 0.101518 US\$

TABLE 23. INDIAN AIR FORCE FLIGHT EQUIPMENT

Name and Number of Aircraft	Type	Made In	Quantity
<u>Attack, Bomber, Fighter, Interceptor, Reconnaissance Aircraft</u>			
Ajeet	Interceptor	India	89
Canberra (Bl) 58/74/T.13/B(1).12	Bomber	UK	50
Gnat F.1	Interceptor	India	70
HF-24 Marut	Attack	India	90
HJT-16 Kiran MKI	Fighter	India	110
HJT-16 Kiran MKIA	Fighter	India	50
HJT-16 Kiran MKII	Fighter	India	20
Jaguar International	Fighter/Bomber	UK	16
MiG-21 FL/MF/BIS Fish Bed	Interceptor	USSR	450+
MiG-23 BN Flogger	Fighter/Bomber	USSR	70+
MiG-23 MF Flogger	Interceptor	USSR	40
MiG-25 R/U Foxbat	Reconnaissance	USSR	12/2
Mirage 2000	Interceptor	France	40
SU-7B Fitter-A	Fighter	USSR	75
<u>Transport Aircrafts</u>			
An-12 Cub		USSR	30
An-32 Cline		USSR	96
(on order)			
Boeing 737-200		USA	2
C-119G Packet		USA	38
C-47		USA	25
DHC-3 Otter		Canada	29

TABLE 23. INDIAN AIR FORCE FLIGHT EQUIPMENT (concluded)

Name and Number or Aircraft	Type	Made In	Quantity
<u>Transport Aircrafts (Cont'd)</u>			
DHC-4 Caribou		Canada	20
HS-478M		UK	42
<u>Trainer Aircrafts</u>			
HJT-16 Kiran		India	44
HPT-32		India	100+ (rec'd)
HT-2		India	70
MiG-212T Mongol		USSR	40
MiG-23 UM Flogger		USSR	15
<u>Helicopters</u>			
Allouete Chetah		India	200
Mil MI-4		USSR	45
Mil MI-8 Hib		USSR	50
SA 316B Chetah		India	120

TABLE 24. INDIAN NAVY FLIGHT EQUIPMENT

Name and Number of Aircraft	Made In	Quantity
Breguet BR-1050 Alize	UK	20
Brittan-Norman Islander	UK	11
Brittan-Norman Defender	UK	5
de Havilland Devon	Canada	2
HJT-16 Kiran MK1A	India	15
Hughes-300	USA	4
Kamov Ka-25 Hormone A'	USSR	5
Ilyushin Il-38 May	USSR	3
L-1049 Super Constellation	USA	4
Sea Harriers FRS MK51	UK	6
Sea Harriers T.MK-4	UK	2
Sea Hawks	UK	25
Sea King MK 42/42/A	UK	14
Vampire T.MK55	UK	4
<u>Helicopters</u>		
SA316B Chetah (Alloutte III)	France	18

Table 25. MILITARY AIRPORTS OF INDIA

1 of 2

Airport	Geographic Coordinates		Runway Length/Type	Can Handle Civil Traffic
Agra	N27 09.0	E077 58.0	9000'/Concrete	✓
Baghddgra	N26 41.0	E088 20.0	9000'/Concrete	✓
Barrackpore	N22 39.2	E088 27.0	Not available	✓
Bangalore	N12 57.1	E077 40.0	10850'/Concrete	✓
Barielly	N28 35.0	E079 27.0	9000'/Concrete	✓
Begumpet	N17 27.2	E 78 27.8	Not Available	
Car Nicobar	N09 09.0	E092 49.0	7500'/Concrete	✓
Chakulia	N22 27.9	E086 42.5	7283'/Concrete	✓
Chakeri (Kanpur)	N26 24.0	E080 25.0		
Chabua	N27 28.0	E095 07.0	9600'/Unpaved	Light A/C only
Chandigarh	N30 40.0	E076 47.0	9000'/Concrete	✓
Cochin	N09 57.0	E076 15.0	6000'/Asphalt	✓
Daboim (Goa)	N15 22.7	E073 49.7	7850'/Asphalt	✓
Dundigul (A.F. Academy)	N17 37.8	E078 24.3	8250'/Concrete	
Didar	N17 55.0	E077 30.0	Not Available	
Ferozpur	Not Available		Not Available	
Gilgit	Not Available		Not Available	
Gorakhpur	N26 44.0	E083 27.0	9000'/Concrete	✓
Gurgaon	Not Available		Not Available	
Gwalior	N26 17.0	E078 14.0	8970' Concrete	✓
Hakimpet	N17 27.2	E 78 27.8	Not Available	
Halwara	Not Available		Not Available	
Hindon	Not Available		Not Available	
Jaipur	N26 49.4	E075 48.2	5955'/Tarmal	✓
Jammu	N32 42.0	E074 50.0	5556'/Steel Planking	No
Jormat	N26 44.0	E094 11.1	9000'/Concrete	
Jharsuguda	N21 54.9	E084 03.1	6175'/Concrete	Light A/C
Kacharapara	Not Available		Not Available	
Kakaikonda	Not Available		Not Available	
Kumbhigram	N24 54.7	E082 58.8	5857' Tarmal	✓
Leh	N34 08.0	E077 33.0	Not Available	
Manipur	N25 53.0	E093 46.0	5770'/Asphalt	✓
Muzaffarpur	N26 07.0	E085 18.9	3999' Bitumen	No
Ozar	N20 07.0	E073 55.0	9800' Unpaved	Light A/C
Prithigunn	N25 52.0	E082 01.0	6000'/Concrete	No
Pune	N18 35.0	E073 55.0	8800'/Concrete	✓
Ranchi	N23 18.8	E085 19.4	8900'/Concrete	✓
Safdarjung	N28 35.1	E77 12.5	3780'/Tarmal	Light A/C
Saharanpur	Not Available		Not Available	
Srinagar	N33 59.0	E074 47.0	12,000'/Concrete	✓

Table 25. MILITARY AIRPORTS

2 of 2

Airport	Geographic Coordinates		Runway Length/Type	Can Handle Civil Traffic
Sulur	N11 01.0	E077 10.0	6457'/Concrete	✓
Tambaram	N12 54.0	E080 07.0	4764'/Concrete	✓
Tezpur	N26 43.0	E092 47.0	Not Available	
Udampur	N32 65.0	E075 09.0	9010'/Asphalt/ Concrete	✓
Yellahanka	N13 08.0	E77 37.0	7217'Concrete	✓

All civilian airports in Category I, II and III can also support military aircrafts.

TABLE 26. MILITARY TRANSPORT AND CIVILIAN AIRCRAFTS OF INDIA

1 of 2

Name of Aircraft	Number of Aircrafts	Passenger Capacity	Freight Capacity (lbs.)	Minimum Runway Requirements (ft.)	Range (miles)	Maximum Speed (mph)
<u>Military Transport Aircrafts</u>						
Antonov An-12 Cub	30	100 Paratroops	or 44,092	-	2,237	482
Antonov An-32 Cline	96	39 Troops or 30 Paratroops	or 6,000	-	1,367	317
Boeing 737-200	2	130 Troops	+ 43,000	-	2,060	576
C-119G Packet	38	62 Troops	-	-	1,770	281
C-47	25	32 Troops	or 4,500	-	1,600	230
DHC-3 Otter	29	14 Troops	or 3,153	-	875	160
DHC-4 Caribou	20	32 Troop	or 6,000	-	242	216
HS-748M	42	55 Troops	+ 14,000	2,500	200	350
<u>Air India Aircrafts</u>						
Boeing 707	1	144	14,000	8,000	5,300	535
Boeing 747	10	394	34,920	6,000	5,750-6,000	562
Airbus A300B4	3	331	20,216	5,445	3,400	582

TABLE 26. MILITARY TRANSPORT AND CIVILIAN AIRCRAFTS OF INDIA

2 of 2

Name of Aircraft	Number of Aircrafts	Passenger Capacity	Freight Capacity (lbs.)	Minimum Runway Requirements (ft.)	Range (miles)	Maximum Speed (mph)
<u>Indian Airlines Aircrafts</u>						
Airbus A300B2	8	331	70,547	5,445	3,400	582
Airbus A300B4	2	331	20,216	5,455	3,400	582
Boeing 737-200	25	130	43,000	6,000	2,060	576
Fokker F-27-100/400/600	8	48	14,193	2,310	1,160	302
HS748	12	55	14,000	2,500	200	350

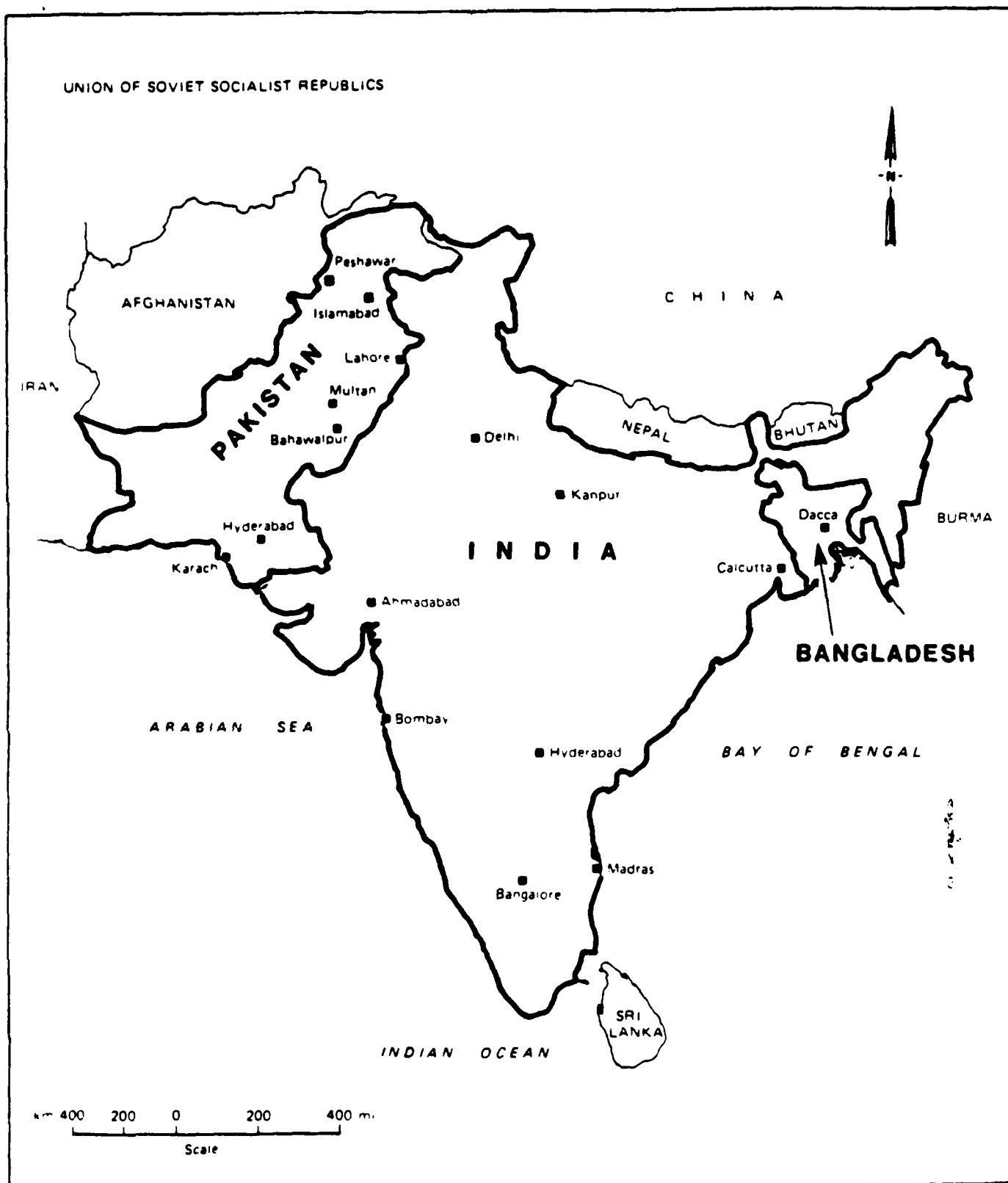


Figure 1 — LOCATION MAP
Bangladesh, India and Pakistan

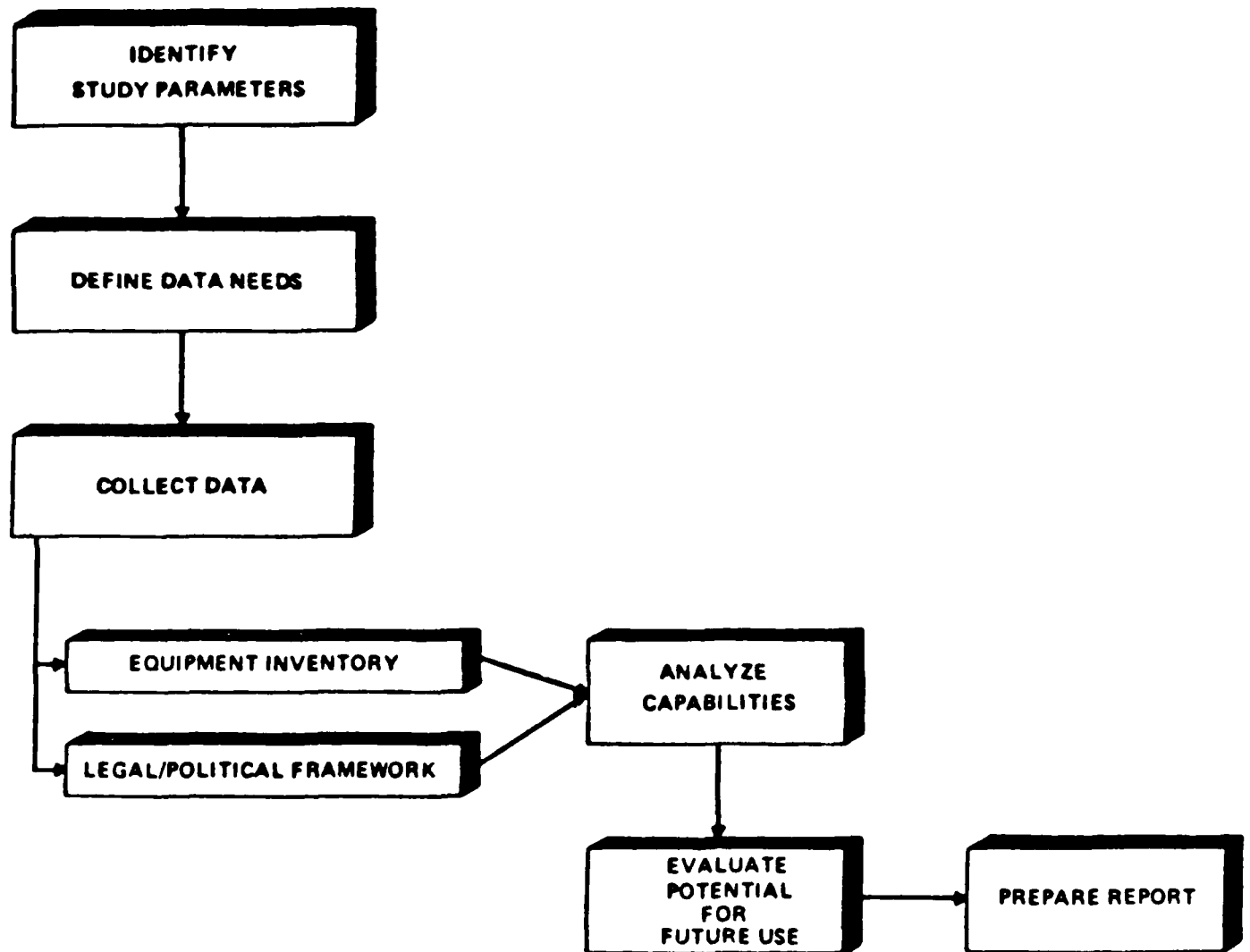


Figure 2: Research Methodology

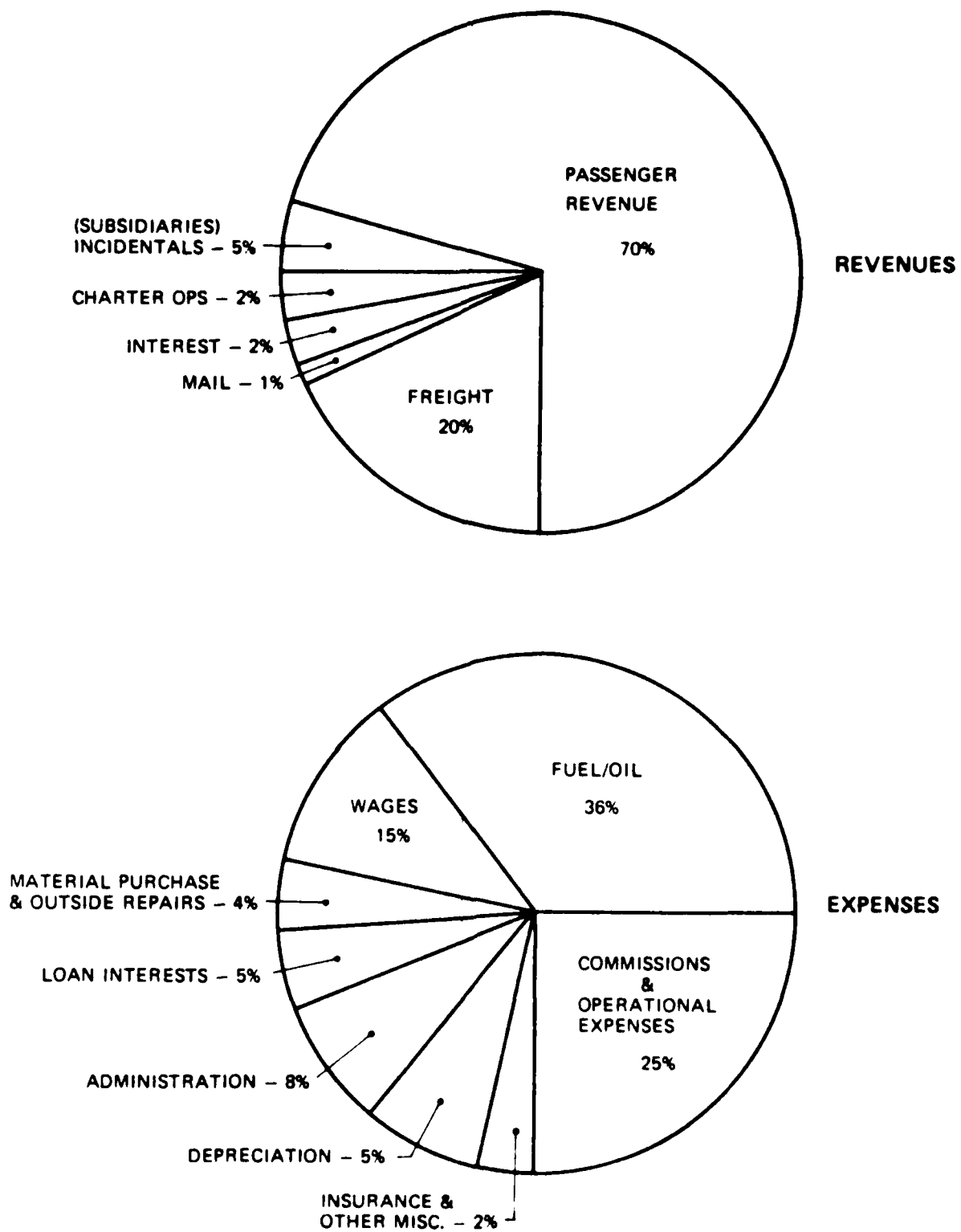


Figure 3: Financial Statistics – Air India

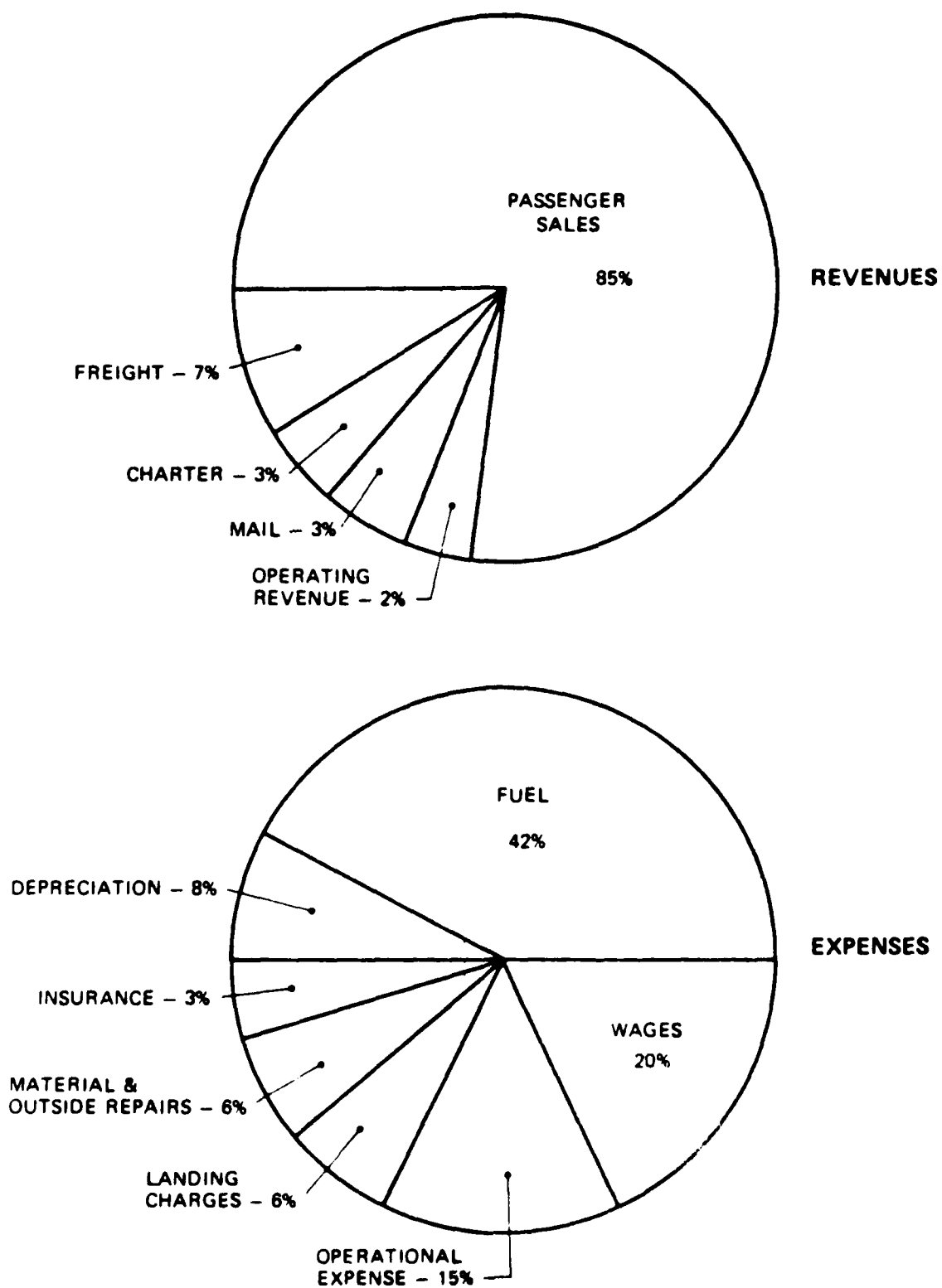


Figure 4: Financial Statistics – Indian Airlines

**FOKKER-VFW F 27 FRIENDSHIP (except Mk 500) and
FAIRCHILD INDUSTRIES F-27**

First flights 1955/1958

Short medium-range airliner

Data F 27 Mk 200

Power plant: Two Rolls-Royce Dart Mk 532-7R (RDa 7 rating) turboprop engines (each 2 140 shp plus 525 lb/238 kg st for T.O.)

Wing span: 95 ft 2 in (29 00 m)

Length overall: 77 ft 3½ in (23 56 m)

Cabin, excluding flight deck:

Length 47 ft 5 in (14 46 m) Max width 8 ft 4½ in (2 55 m) Max height 6 ft 7½ in (2 02 m) Volume 2 136 cu ft (60 5 m³)

Freight hold max:

fwd 169 cu ft (4 78 m³) aft 100 cu ft (2 83 m³)

Max weight-limited payload, 44 seats: 12 899 lb (5 851 kg)

Max T.O. weight: 45 000 lb (20 410 kg)

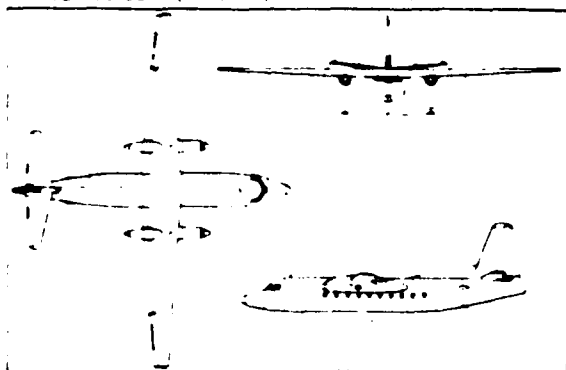
Normal cruising speed at 20 000 ft (6 100 m), at 38 000 lb (17 237 kg) AOW: 262 knots (302 mph/486 km/h)

Max rate of climb at S.L. AOW of 40 000 lb (18 143 kg): 1 475 ft (450 m)/min

Service ceiling at 38 000 lb (17 237 kg) AOW: 29 500 ft (9 000 m)

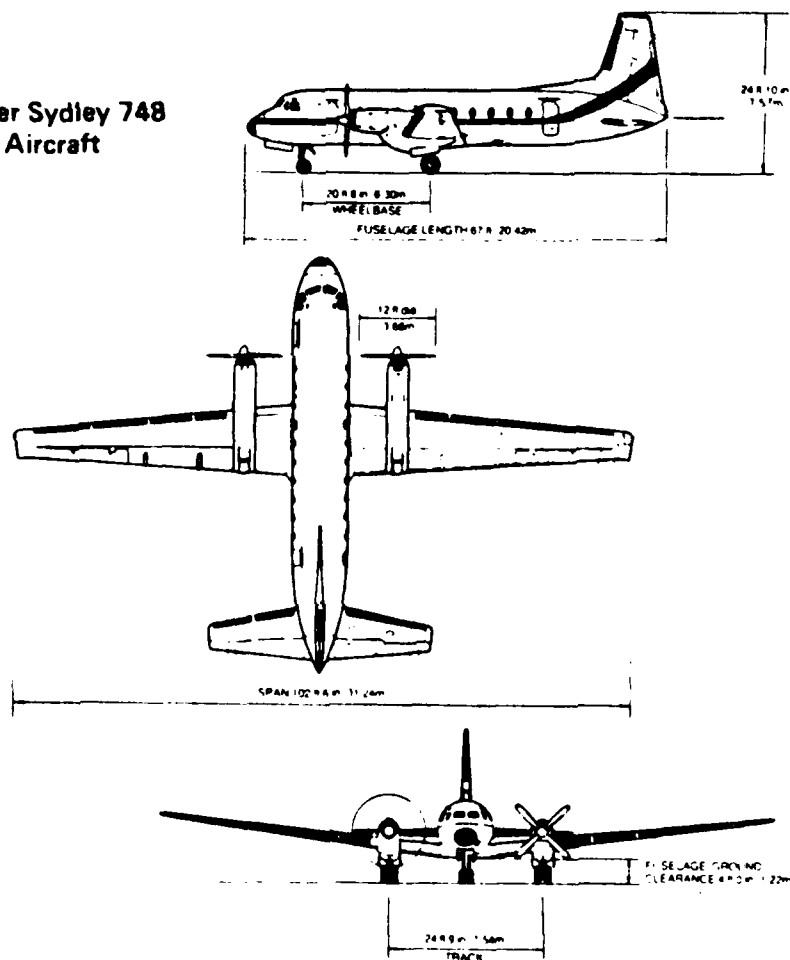
Range (ISA, zero-wind conditions), reserves for 130 nm (149 mile, 240 km) diversion, 30 min hold at 10 000 ft (3 050 m), 10% flight fuel with 10 340 lb (4 690 kg) payload at 25 000 ft (7 620 m): 1 160 nm (1 335 miles, 2 148 km)

Accommodation: Flight crew of two or three and seating for up to 48 passengers or equivalent cargo, or VIP layout (typically, for 10 persons)



**Figure 5: Flight Equipment and Facilities
General Aircraft Data — F27**

**Hawker Sydley 748
Aircraft**



**Hawker Sydley 748 (HS 748)
Short/Medium Range Aircraft**

Power Plant 2 Rolls Royce Dart R DA7 MK 536 2 engines
Wing Span 102 feet
Length 67 feet
Cabin excluding Flight Deck
Length 46 feet Max width 8 feet Height 6'4"
Volume 1990 cubic feet
Max Weight Limited Payload 55 passengers 14,600 lbs
Max Take Off Weight 46,500 lbs or 21,092 kgs
Normal Cruising Speed 300 knots or 350 miles approx.
Service Ceiling at 40,000 lbs AUW 30,000 feet
Range (ISA, Zero Wind Condition) Reserves for 200 nautical miles or 230 mile diversion
Accommodation Flight crew of 2 or 3 with maximum 55 passengers in the cabin

**Figure 6: Flight Equipment and Facilities
General Aircraft Data — HS748**

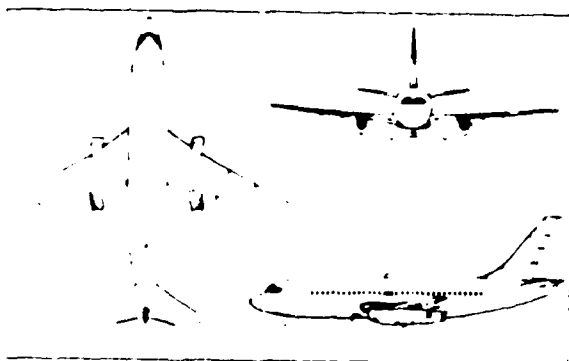
BOEING 737-200 (USA)

First flight 1967

Short range airliner

Data 737-200

Power plant: Two Pratt & Whitney JT8D-9 turbofan engines (each 14 500 lb, 6 575 kg st), optionally, JT8D-7 engines (each 14 000 lb, 6 350 kg st) or JT8D-15 engines (each 15 500 lb, 7 030 kg st)



Wing span: 93 ft 0 in (28.35 m)

Length overall: 100 ft 0 in (30.48 m)

Cabin, including galley and toilet:

Length 68 ft 6 in (20.88 m) Max width 11 ft 6½ in (3.52 m) Max height 7 ft 2 in (2.18 m) Volume 4 636 cu ft (131.28 m³)

Freight hold volume:

fwd 370 cu ft (10.48 m³) rear 505 cu ft (14.30 m³)

Max payload at brake release weight of 115 500 lb (52 390 kg): 35 700 lb (16 193 kg)

Max T-O weight: 115 500 lb (52 390 kg)

Max cruising speed, with JT8D-9 engines at an average cruise weight of 90 000 lb (40 823 kg) at 22 600 ft (6 890 m): 500 knots (576 mph, 927 km/h)

Max rate of climb at S/L, engines as above, at 100 000 lb (45 355 kg) AUW: 3 760 ft (1 146 m)/min

Range with max payload, cruising at 30 000 ft (9 145 m), including reserves for 174 nm (200 mile; 321 km) diversion and 45 min continued cruise, with 115 passengers: 2 060 nm (2 370 miles, 3 815 km)

Accommodation: Flight crew of two and seating for up to 130 passengers. Freight holds underfloor, forward and aft of wing

Figure 7: Flight Equipment and Facilities
General Aircraft Data — Boeing 737

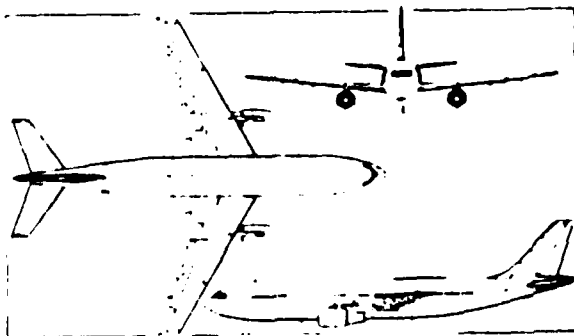
AIRBUS A-300B (International)

Short-range large-capacity airliner

Date: A-300B2

Power plant: Two General Electric CF6-50C turbofan engines (each 51 000 lb., 23 130 kg st)

Wing span: 147 ft 1½ in (44 84 m)



First flight 1972

Length overall: 175 ft 9 in (53 57 m)

Cabin, excluding flight deck:

Length 128 ft 6 in (39 15 m) Max width 17 ft 7 in (5 35 m) Max height 8 ft 4 in (2 54 m)

Underfloor cargo hold volume:

forward 2 652 cu ft (75 1 m³) rear 1 652 cu ft (46 8 m³) extreme rear 565 cu ft (16 0 m³)

Max total volume for bulk loading: 4 869 cu ft (137 9 m³)

Max payload: 70 020 lb (31 760 kg)

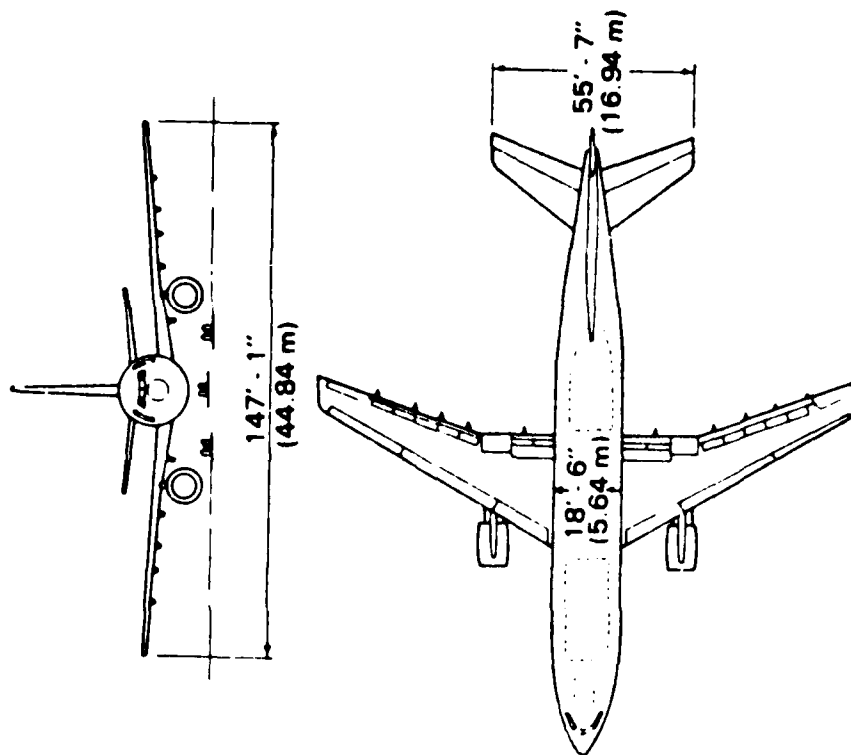
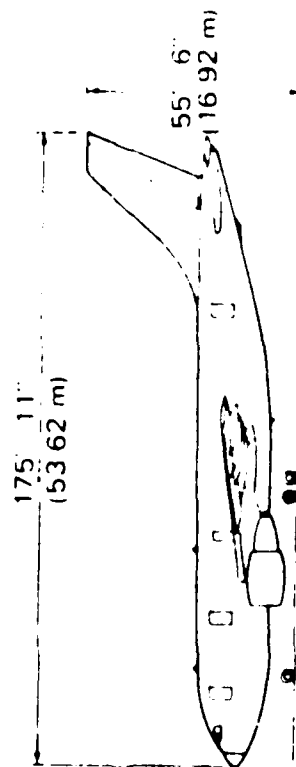
Max T-O weight: 302 000 lb (137 000 kg)

Max cruising speed at 25 000 ft (7 620 m): 505 knots (582 mph, 937 km/h)

Range with max payload, reserves for 200 nm (230 mile; 370 km) diversion, 45 min hold at 5 000 ft (1 525 m) and 5% en-route burn-off: 870 nm (1 000 miles, 1 610 km)

Accommodation: Flight crew of two to five and seating for up to 331 passengers in a single-class high-density layout. Underfloor baggage/cargo holds fore and aft of wings. Forward hold will accommodate four 88 × 105 × 64 in (224 × 267 × 163 cm) pallets or twelve LD3 containers. Rear hold will accommodate six LD3 containers each of 150 cu ft (4 25 m³) capacity

Figure 8: Flight Equipment and Facilities
General Arrangement Airbus A-300B 2



FLEET TECHNICAL DATA

<input type="checkbox"/> MAX TAXI GROSS WT	165900 kg	365740 lb
<input type="checkbox"/> MAX LANDING WT	136000 kg	299820 lb
<input type="checkbox"/> PAYLOAD	32000 kg	70547 lb
<input type="checkbox"/> FUEL CAPACITY	62000 ltrs	136381 IG
<input type="checkbox"/> AVERAGE FUEL CONSUMPTION (PER/HRI)	7820 ltrs	1720 IG
<input type="checkbox"/> NORMAL CRUISING SPEED	851 kmph	528 mph
ENGINES	GE CF 6-50C2	
<input type="checkbox"/> ENGINE THRUST	23815 kg	52500 lb
<input type="checkbox"/> RANGE (FULL PAXI)	5500 km	3400 st miles
<input type="checkbox"/> MAX CRUISE ALTITUDE (WITH CAPACITY PAYLOAD)	12190 m	40000 ft
<input type="checkbox"/> CARGO CAPACITY	9170 kg	20216 lb

Figure 9: Flight Equipment and Facilities
General Arrangement Airbus A300B4

BOEING 747 (USA)

First flight 1969

Long-range large-capacity airliner

Data: 747-200B

Power plant: Four Pratt & Whitney JT9D-3 turbofan engines (each 43 500 lb; 19 730 kg st); or JT9D-3W engines (each 45 000 lb; 20 410 kg st); or JT9D-7 engines (each 45 500 lb; 20 635 kg st); or JT9D-7W engines (each 47 000 lb; 21 320 kg st)

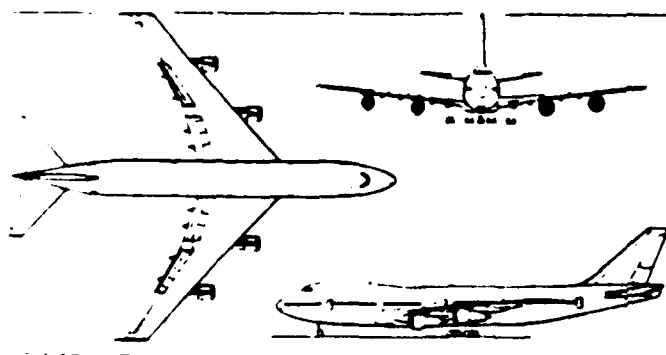


Photo and Drawing: 747-200B

Wing span: 195 ft 8 in (59.64 m)

Length overall: 231 ft 4 in (70.51 m)

Cabin, including toilets and galleys:

Length 185 ft 0 in (56.39 m) Max width 20 ft 0 in (6.10 m) Max height 8 ft 4 in (2.54 m) Volume, passenger deck 27 860 cu ft (789 m³)

Baggage hold (containerized) volume:

fwd 2 768 cu ft (78.4 m³) aft 2 422 cu ft (68.6 m³)

Bulk volume: 1 000 cu ft (28.3 m³)

Max payload (with JT9D-7W engines): 164 745 lb (74 728 kg)

Max T-O weight (same engines as above): 775 000 lb (351 540 kg)

Max level speed at 30 000 ft (9 150 m) at AUW of 600 000 lb (272 155 kg): 528 knots (608 mph; 978 km/h)

Cruise ceiling: 45 000 ft (13 715 m)

Range (long-range cruise, FAR reserves), with 79 618 lb (36 114 kg) payload: 5 748 nm (6 620 miles; 10 650 km)

Accommodation: Flight crew of three with provision for two observers. Seating for up to 500 economy class passengers. Freight holds underfloor, forward and aft of wing

Figure 10a: General Aircraft Data — Boeing 747

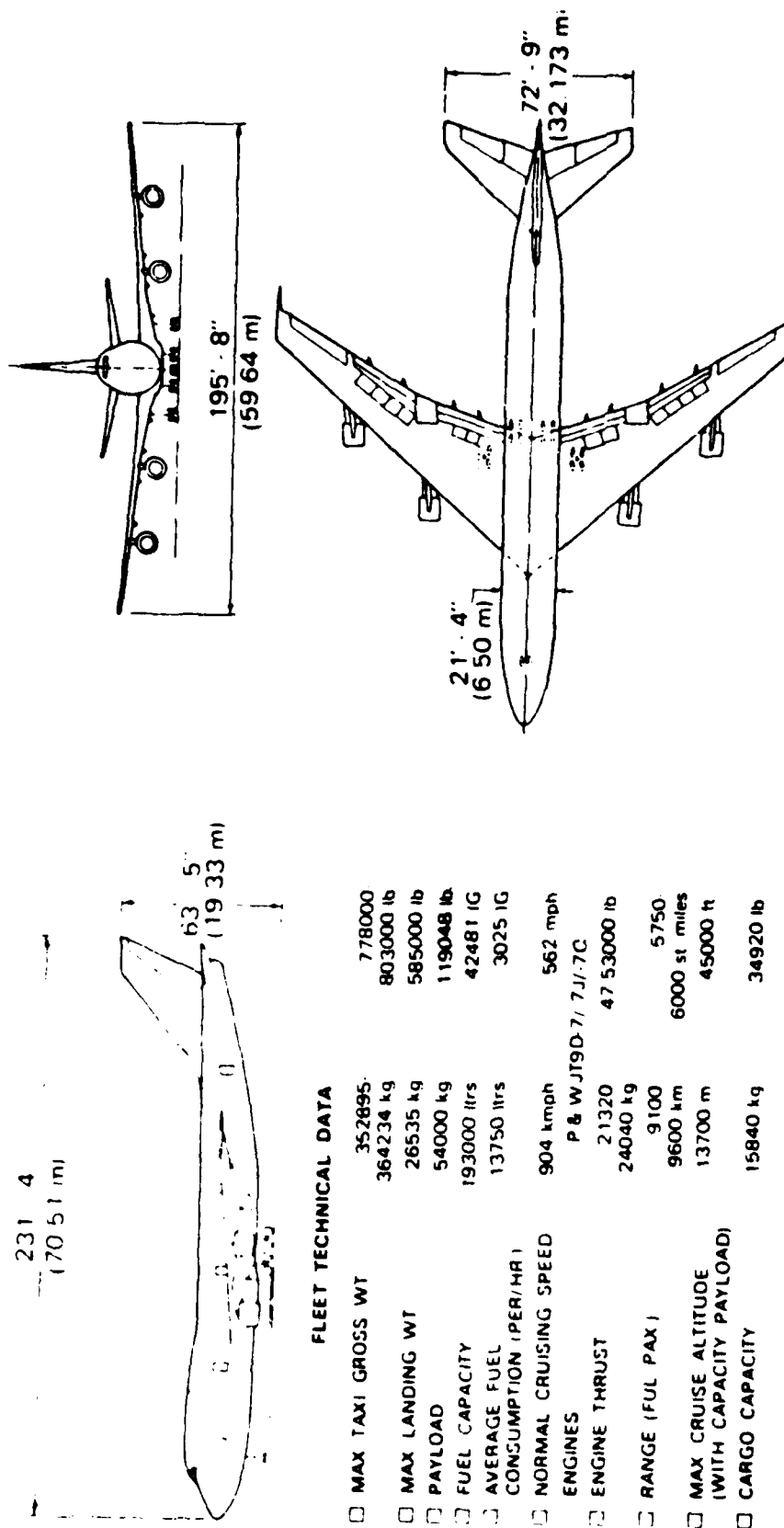


Figure 10b: Flight Equipment and Facilities
General Arrangement Boeing 747-237B

BOEING 707-320 and -420 (USA)

First flights 1959

Long-range airliner

Date: 707-320B Intercontinental

Power plant: Four Pratt & Whitney JT3D-7 turbofan engines (each 19 000 lb; 8 618 kg st), fitted with double thrust reversers

Wing span: 145 ft 9 in (44.42 m)

Length overall: 152 ft 11 in (46.61 m)

Cabin, excluding flight deck:

Length 111 ft 6 in (33.99 m) Max width 11 ft 8 in (3.55 m) Max height 7 ft 7 in (2.31 m) Volume 7 983 cu ft (226 m³)

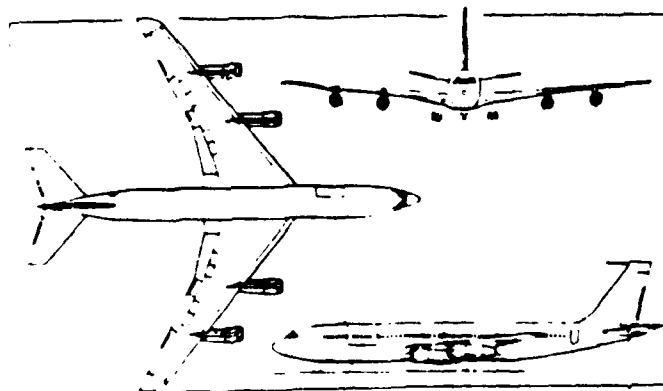


Photo and Drawing: 707-320C

Baggage compartment:

fwd 870 cu ft (24.65 m³) rear 905 cu ft (25.62 m³)

Max payload: 53 900 lb (24 448 kg)

Max T-O weight: 333 600 lb (151 315 kg)

Max cruising speed at 25 000 ft (7 620 m), at average cruising weight: 525 knots (605 mph; 973 km/h)

Rate of climb at S/L, weight as above: 4 000 ft (1 219 m)/min

Service ceiling, weight as above: 39 000 ft (11 885 m)

Range with max payload, allowances for climb and descent, no reserve (707-320B fitted with JT3D-3 or 3B engines only): 5 420 nm (6 240 miles; 10 040 km)

Accommodation: Flight crew of three to five and seating for up to 195 passengers. The 707-320C Convertible version has cargo space of 7 415 cu ft (210 m³) on full upper deck and 1 700 cu ft (48 m³) in two lower-deck holds, or accommodation for up to 219 passengers

53

Figure 11a: General Aircraft Data – Boeing 707

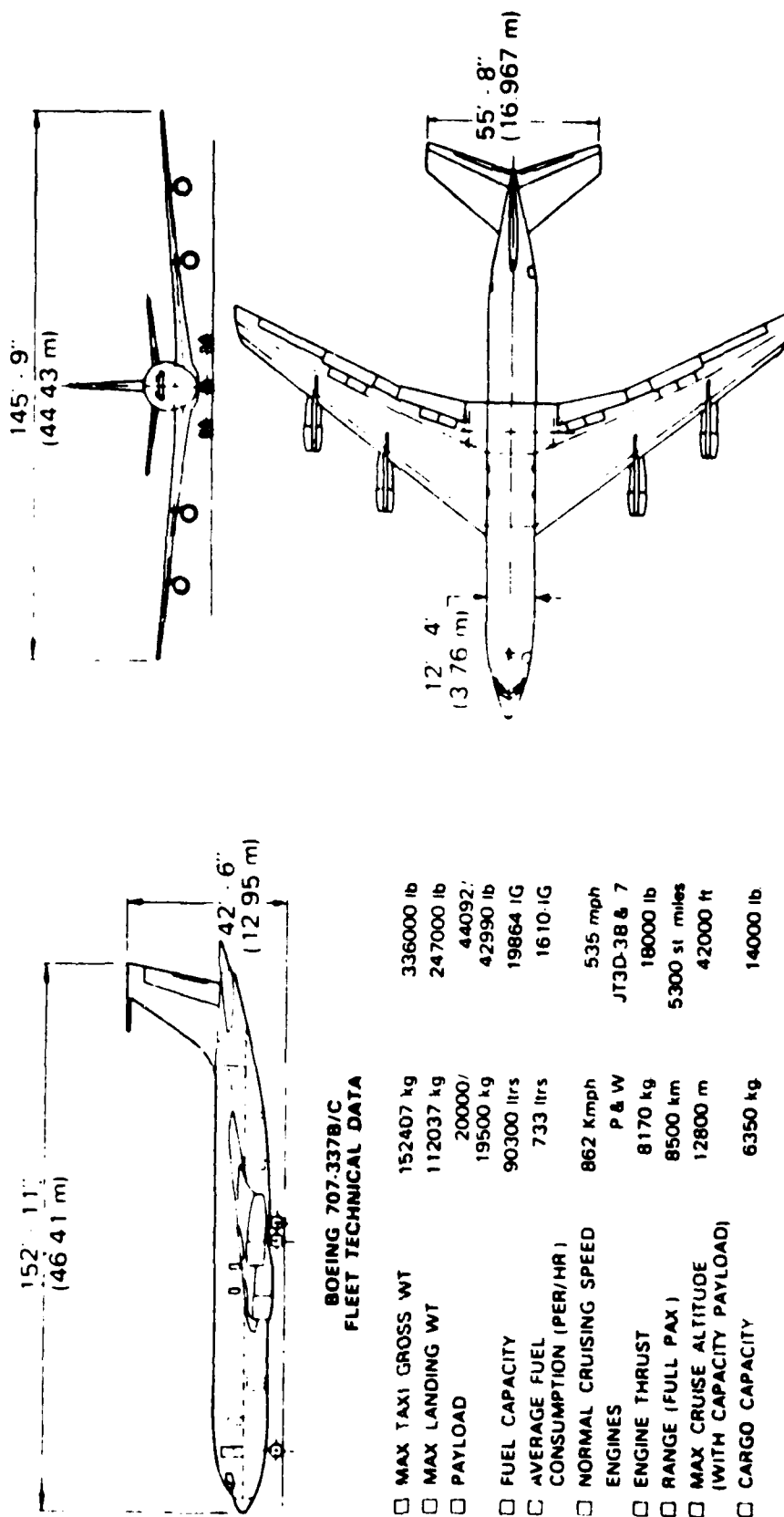


Figure 11b: Flight Equipment and Facilities
General Arrangement Boeing 707

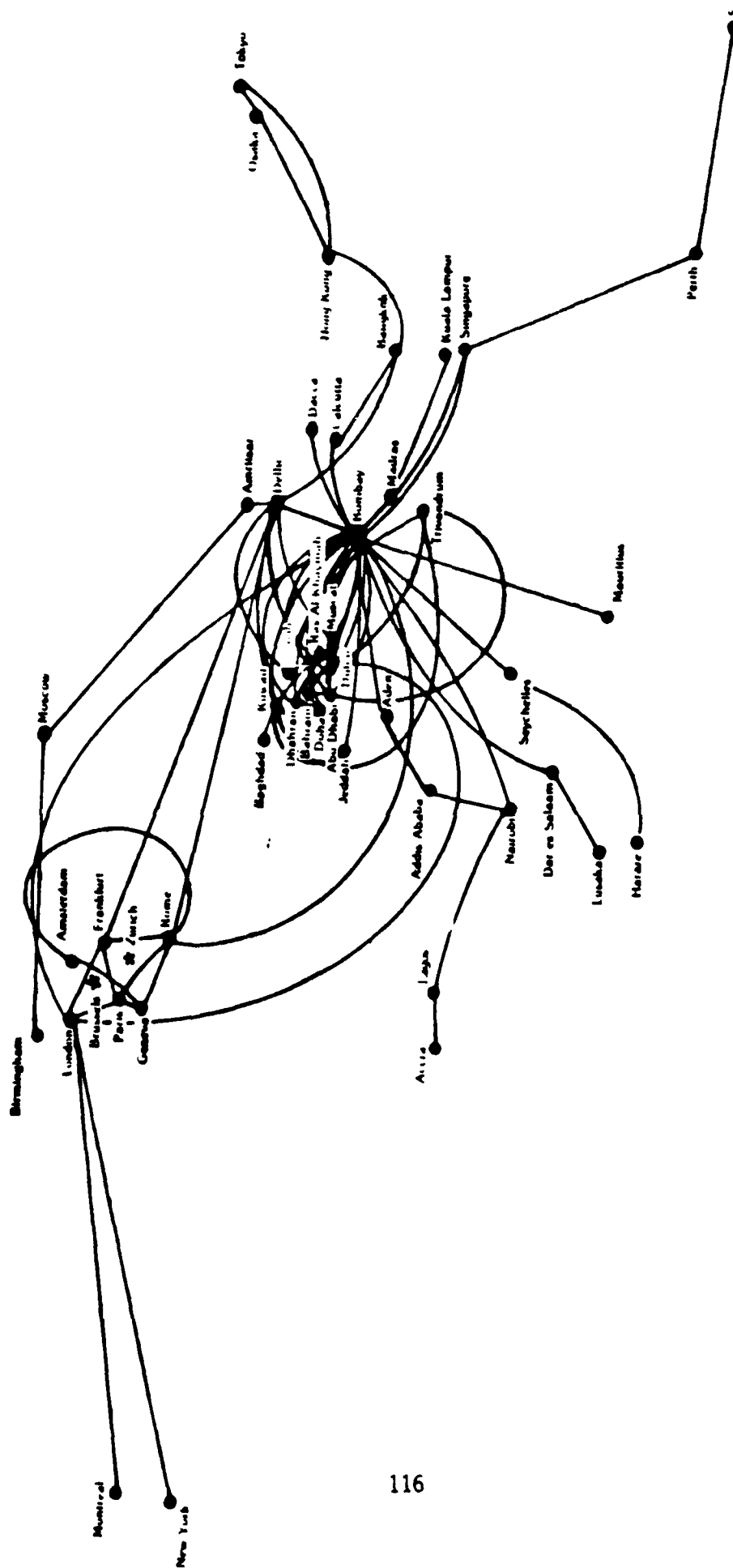
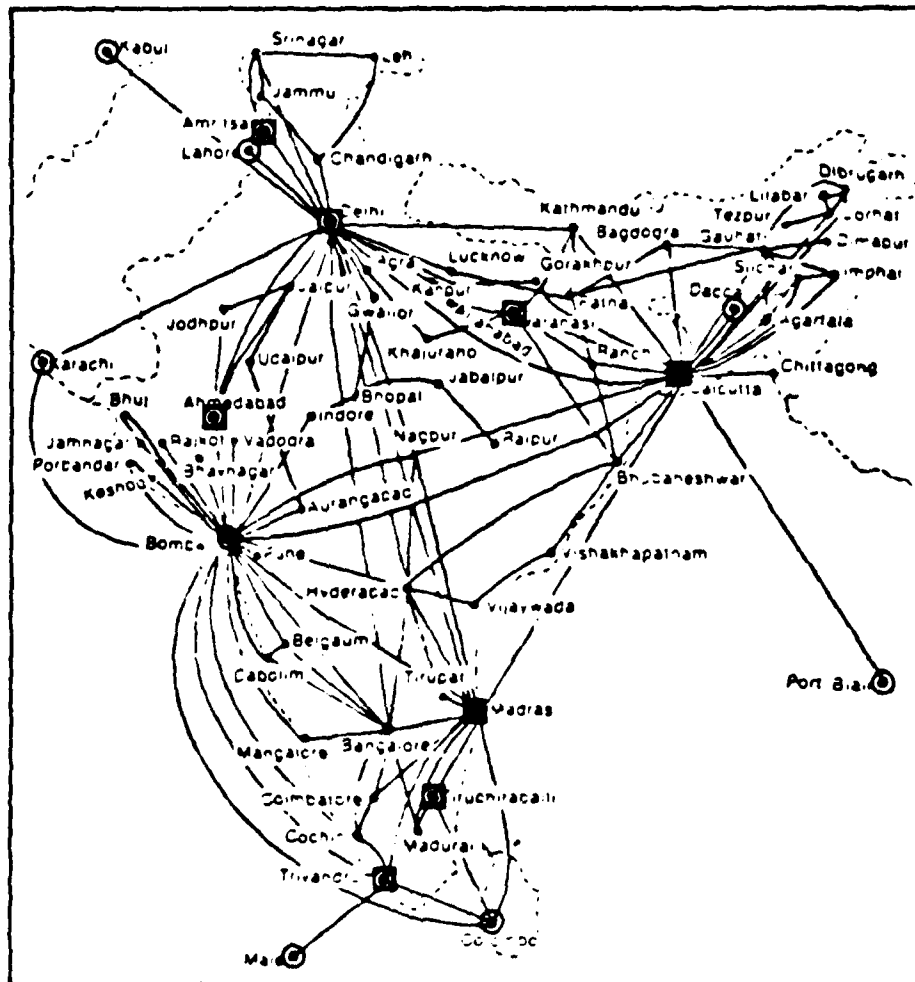


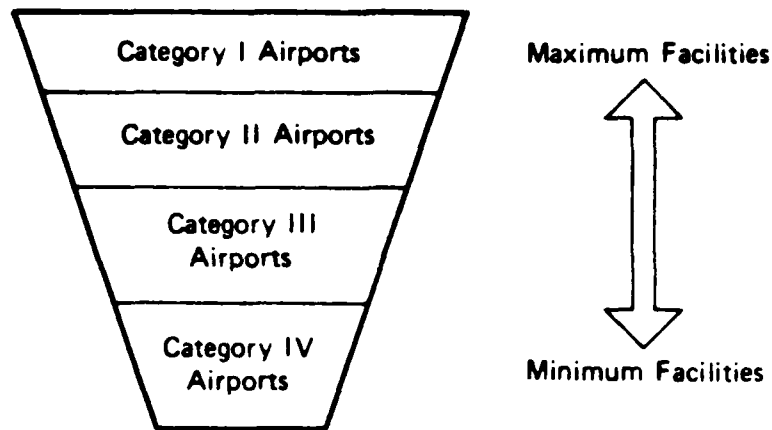
Figure 12: Route Structure – Air India



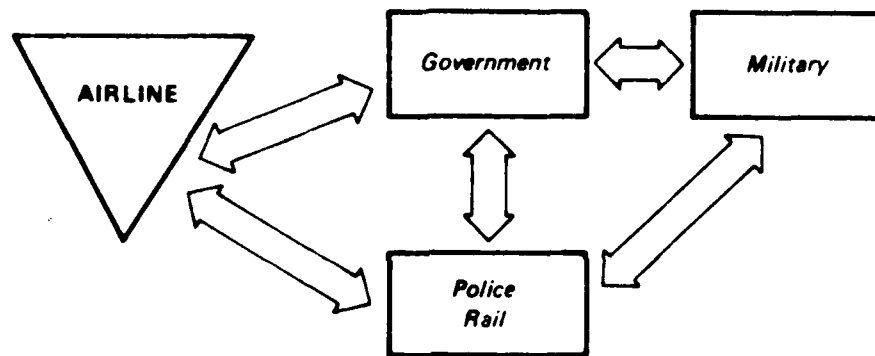
● Foreign airports served by Indian Airlines

■ For airport description, refer to Tables 5.3.2, 5.3.3 and Appendix C.

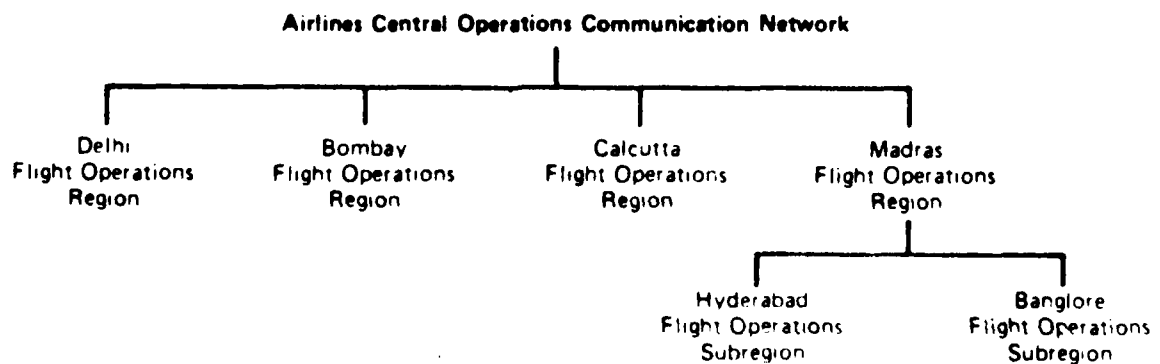
Figure 13: Route Structure – Indian Airlines



COMMUNICATION FACILITIES AT VARIOUS AIRPORTS



COMMUNICATION FLOW BETWEEN VARIOUS DEPARTMENTS



INDIAN AIRLINES COMMUNICATION NETWORK REGIONS

Figure 14: Civil/Military Communication – Setup – Emergency/Peace Time

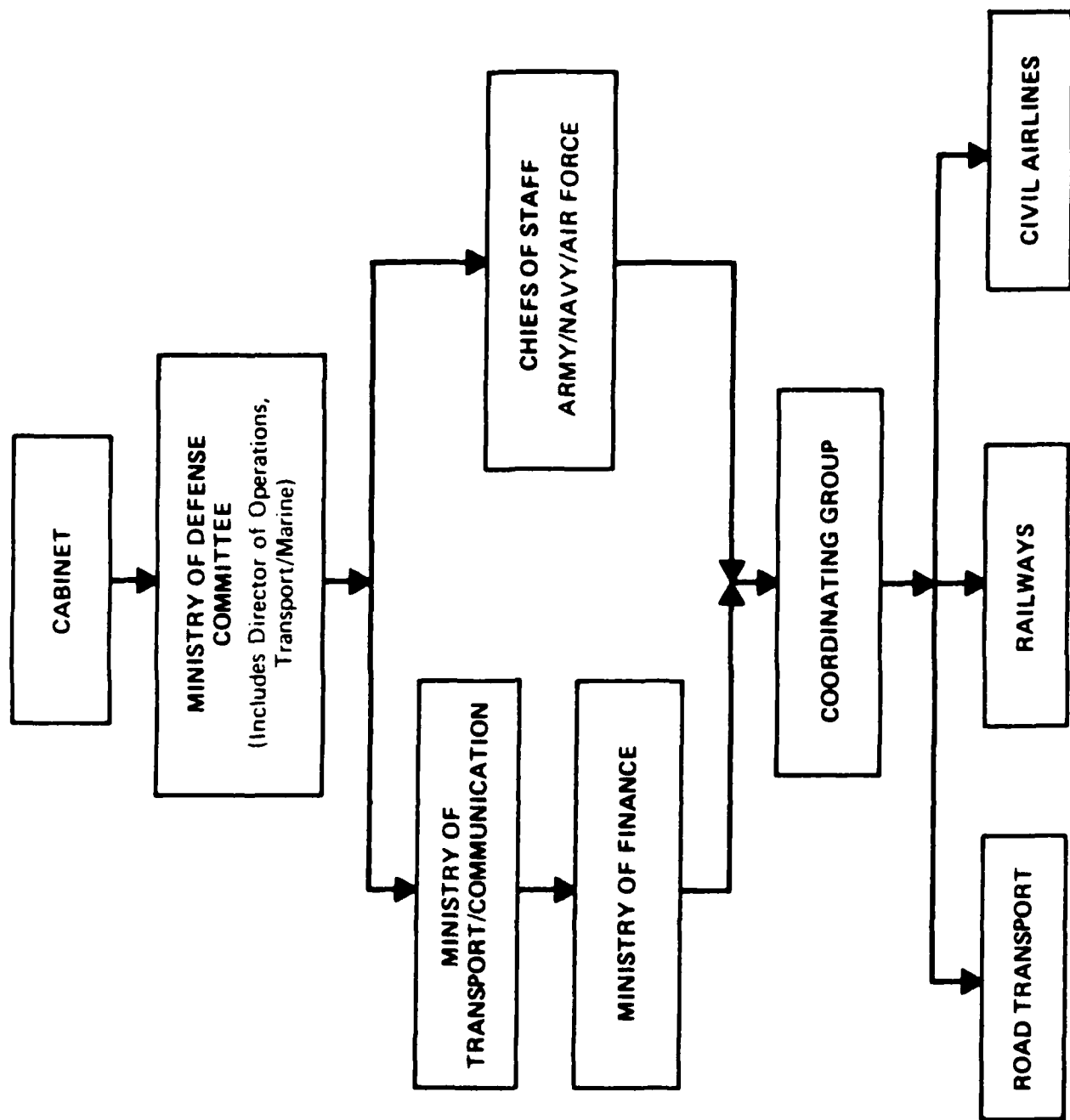


Figure 15: Civil Military Interface

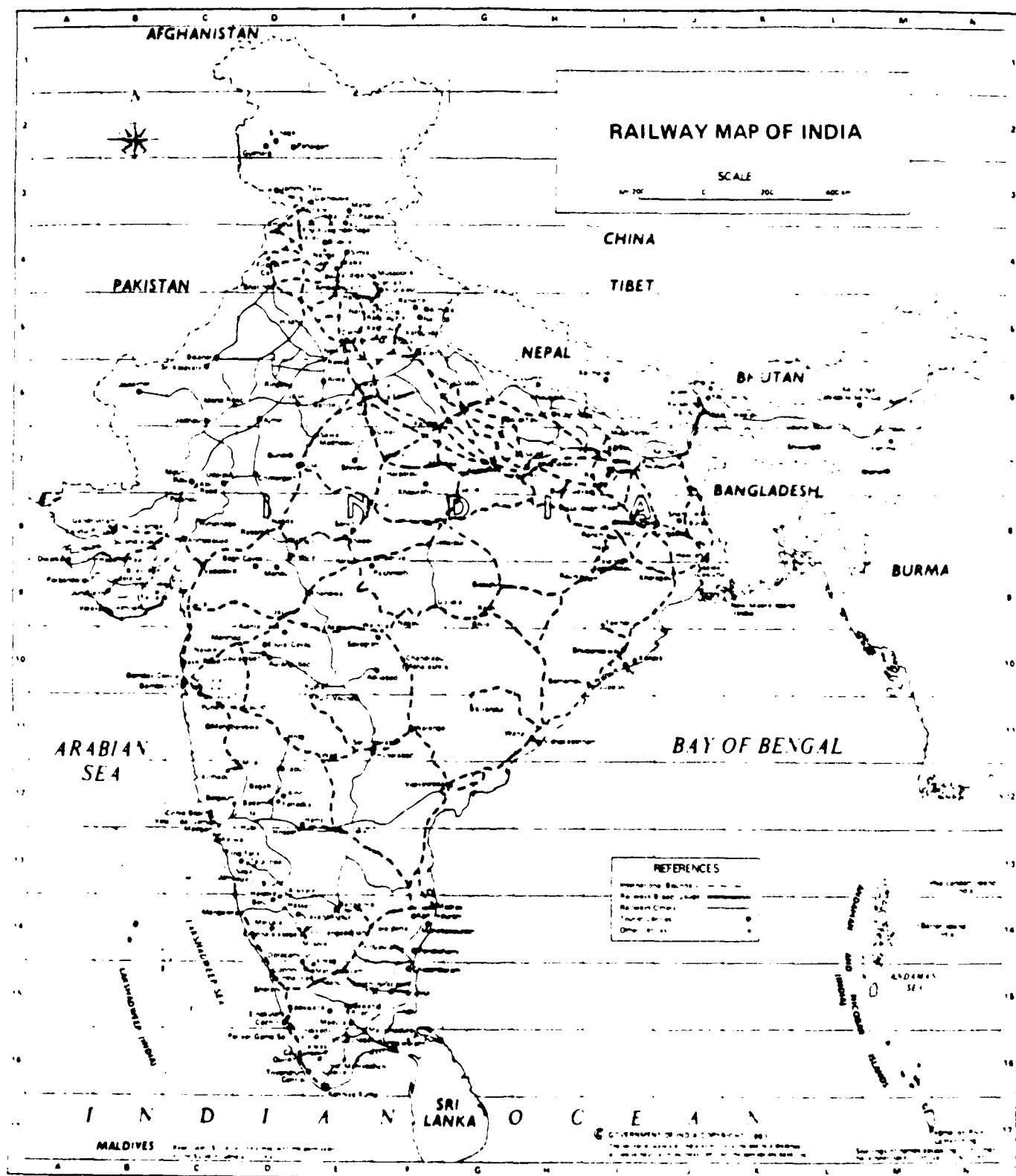


Figure 16: PRINCIPAL RAILWAYS OF INDIA

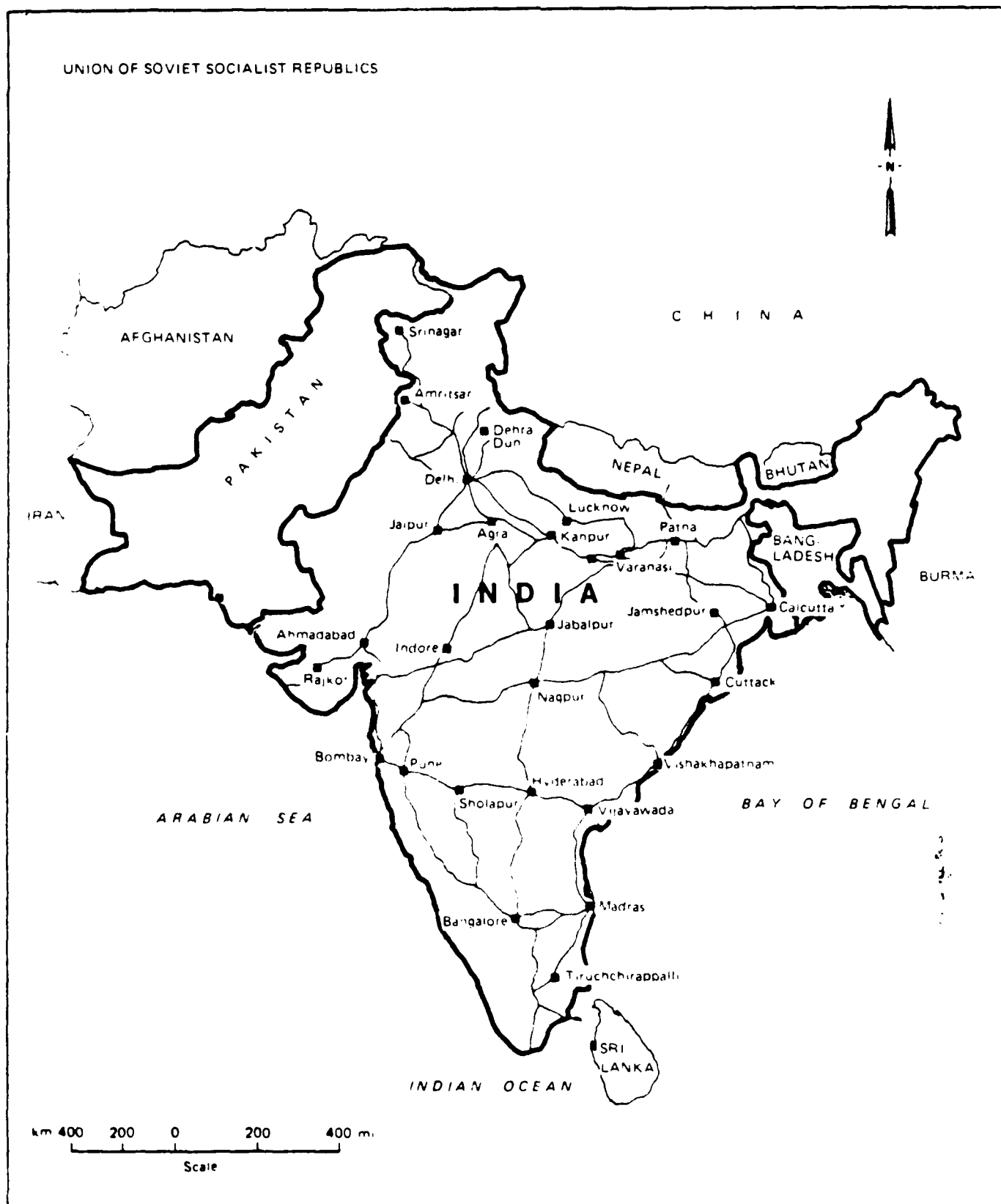


Figure 17: PRINCIPAL ROADS OF INDIA

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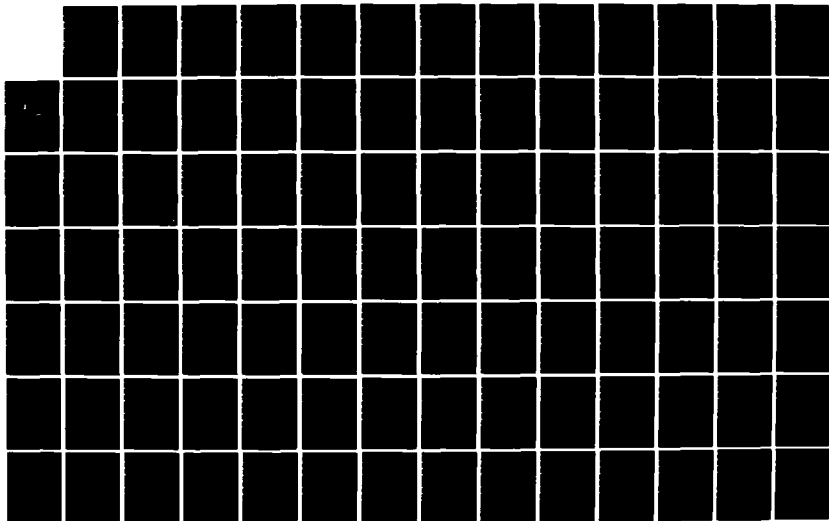
CIVIL AIRLINES/AIR SERVICES IN BANGLADESH INDIA AND
PAKISTAN VOLUMES 1 THRU 4(U) WOODWARD-CLYDE CONSULTANTS
WAYNE NJ A PATWARDHAN ET AL. MAR 85 MDA908-84-C-0834

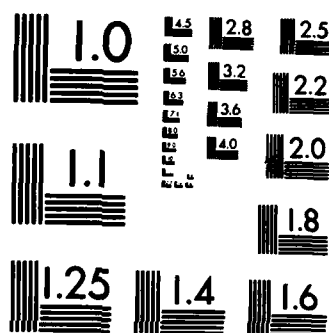
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TEN - YEAR COMPARATIVE STATISTICS 1972/73-1981/82

	1981/82	1980/81	1979/80	1978/79	1977/78	1976/77	1975/76	1974/75	1973/74	1972/73
PROFITABILITY										
Operating Revenue	(Rs in Crores)	608.38	506.07	387.37	306.49	272.27	197.88	126.58	126.14	101.08
Operating Expenses	(Rs in Crores)	873.83	504.74	401.47	270.85	240.83	188.77	130.20	121.84	95.84
Operating Profit/(Loss)	(Rs in Crores)	34.55	301.33	(14.10)	34.64	31.44	9.12	13.37	4.30	5.44
Total Revenue	(Rs in Crores)	621.64	514.93	402.08	309.67	274.54	201.81	137.12	126.38	102.33
Total Expenses	(Rs in Crores)	811.28	538.23	417.02	281.22	268.86	186.26	145.97	126.09	103.27
Net Surplus/(Deficit) Before Tax	(Rs in Crores)	10.36	(21.30)	(14.94)	28.45	6.68	15.55	11.15	0.29	(0.94)
Net Surplus/(Deficit) After Tax	(Rs in Crores)	10.36	(21.30)	(14.94)	28.45	6.68	15.55	11.15	0.29	(0.94)
Operating Cost per Airm	(Rs)	3.41*	3.27*	3.01*	2.46*	2.10*	1.88*	1.35*	1.35*	1.16*
Traffic Revenue per Airm	(Rs)	6.14*	4.86*	4.38*	3.80*	3.61*	3.16*	2.81*	2.30*	2.16*
Operating Ratio (Ratio of Operating Expenses to Operating Revenue)	(%)	84.3	99.9	101.1	88.5	88.5	95.5	102.7	98.4	94.8
SELECTED BALANCE SHEET ITEMS										
Current Assets	(Rs in Crores)	262.89	218.52	188.26	162.83	126.24	87.80	70.88	70.24	61.88
Current Liabilities	(Rs in Crores)	172.10	162.86	130.30	87.99	72.31	64.81	46.78	60.34	30.16
Net Working Capital	(Rs in Crores)	90.79	55.66	57.96	74.84	53.93	22.99	24.10	9.90	31.80
Fixed Assets	(Rs in Crores)	328.80	324.18	285.31	138.19	123.81	130.88	104.22	111.12	114.64
Long Term Debt	(Rs in Crores)	188.07	200.33	177.90	95.95	70.05	89.89	48.92	68.30	77.04
Capital (Equity and Loans)	(Rs in Crores)	140.73	116.38	68.82	68.82	68.82	64.82	61.82	61.82	68.82
Net Worth	(Rs in Crores)	288.78	188.38	170.64	168.01	108.67	89.59	81.03	78.44	73.84
OPERATING RATIOS										
Revenue Hours Run	(No.)	89,884	97,188	65,018	55,403	52,057	48,182	35,138	44,303	43,187
Available Seat Kilometres (Scheduled Services)	(Million)	11,382.8	10,986.4	9,147.5	8,122.2	7,648.2	6,339.0	4,718.4	5,772.4	5,210.8
Available Seat Kilometres (Total)	(Million)	11,807.3	10,886.8	9,282.9	8,781.8	7,887.6	6,502.2	5,142.8	6,339.2	5,838.3
Available Tonne Kilometres (Scheduled Services)	(Million)	1713.630	1613.694	1372.037	1,257.401	1,114.717	963.782	672.642	808.411	718.323
Available Tonne Kilometres (Total)	(Million)	1730.388	1623.402	1388.008	1,289.897	1,132.818	975.774	737.988	898.378	830.163
TRAFFIC										
Revenue Passenger's Carried	(No.)	164,1774	141,817	118,000	104,319	94,316	72,148	51,813	64,858	64,820
Freight Tonnes Carried	(No.)	62,991	63,781	60,918	42,799	41,718	36,977	25,568	28,082	22,814
Revenue Passenger Kilometres (Scheduled Services)	(Million)	7822.8	8809.1	6809.9	5019.7	4757.7	3789.6	2898.8	3758.6	2867.8
Revenue Passenger Kilometres (Total)	(Million)	7888.6	8844.0	6730.8	5088.1	4838.3	3873.8	2898.0	3401.5	2863.2
Passenger Tonne Kilometres	(Million)	694.638	621.192	519.794	458.140	434.286	343.866	238.032	287.224	242.877
Cargo Tonne Kilometres (including Ex-Baggage)	(Million)	370.812	235.017	278.887	283.878	239.588	215.007	141.358	183.831	126.762
Mail Tonne Kilometres	(Million)	19.987	20.882	17.193	14.797	13.042	10.824	8.841	9.282	8.870
Revenue Tonne Kilometres (Scheduled Services)	(Million)	1084.218	978.891	816.874	721.339	688.894	589.586	388.032	470.247	378.999
Charters & A.T.C.L. Tonne Kilometres	(Million)	5.281	3.190	3.172	11.831	9.844	12.371	20.281	24.483	42.195
Total Revenue Tonne Kilometres	(Million)	1091.488	982.081	818.046	733.170	698.738	601.957	408.313	494.710	421.194
LOAD FACTOR (SCHEDULED SERVICES)										
Passenger	(%)	84.8	84.3	82.3	84.3	83.0	84.8	84.8	84.8	81.0
Cargo	(%)	83.4	80.6	88.6	82.1	81.8	82.8	81.8	82.5	82.5
Aircraft Utilization - Revenue Hours per annum	(No.)	3,117	2,988	3,088	3,486	3,538	3,468	2,718	3,408	3,438
PERSONNEL										
No. of Staff (Year end)	(No.)	18,267	18,568	15,360	14,275	11,892	11,048	10,837	10,781	10,428
Available Tonne Kilometres per employee	(No.)	114,700	126,300	113,800	113,800	106,000	96,300	74,400	80,800	88,000

* After including Cost/Altum of based Aircraft/Ship Charge
 a after including Sub-Charge Revenue
 b Based on the No. of staff at the end of the year
 c Based on the Average No. of Staff

Ten-Year Operating and Traffic Statistics

Particulars	1981-82	1980-81
1 Revenue Hours		
(a) A300B	23 301	16 722
(b) Boeing 737	52 187	41 717
(c) Caravelle	-	-
(d) Viscount	-	-
(e) F-27	11 306	15 810
(f) HS-748	19 873	30 527
(g) Dakota	-	-
(h) Hind Aircraft	-	-
(i) Total In Revenue Hours	106 662	105 703
(j) Aircraft Hired Out	5 202	1 281
2 Revenue Kilometres (Million)	51 285	47 017
3 Available Tonne Kilometres (Million)	842 797	663 899
4 Revenue Tonne Kilometres (Million)	437 419	349 719
(a) Passenger	16 798	15 865
(b) Mail	74 727	54 844
(c) Cargo including Excess Baggage	578 944	470 228
(d) Total RTM	795 387	646 140
5 Available Seat Kilometres (Million)	5408 180	4323 158
6 Revenue Passenger Kilometres (Million)	692	898
7 Passenger Load Factor (%)	66.3	63.5
(a) A300B	69.7	60.7
(b) Boeing 737	68.3	68.0
(c) Caravelle	-	-
(d) Viscount	-	-
(e) F-27	69.7	60.7
(f) HS-748	68.3	68.0
(g) Dakota	-	-
(h) All Types	67.9	66.9

Operational Statistics includes those on Indian Airlines Network only unless otherwise specified
The figures for earlier years have been recast accordingly

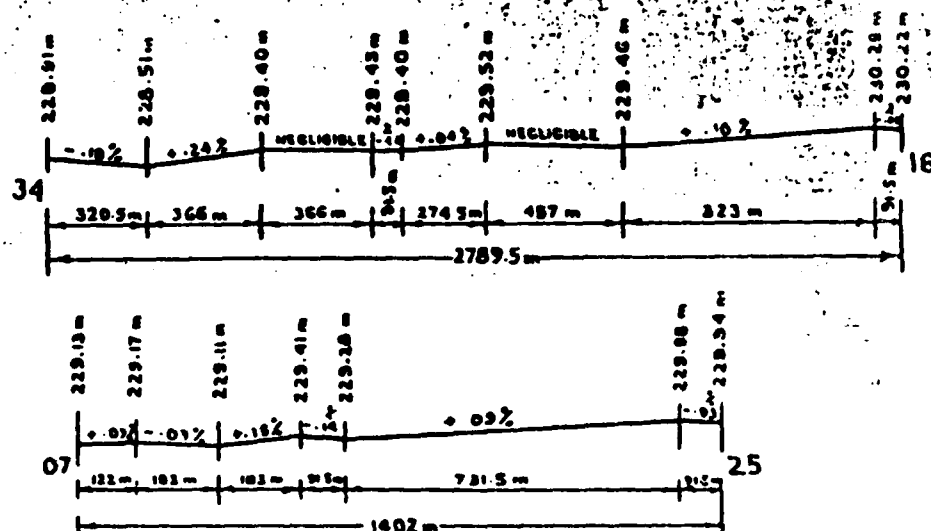
Particulars	1979-80	1978-79	1977-78	1976-77	1975-76	1974-75	1973-74
1 Revenue Hours							
(a) A300B	14 157	11 046	7 929	2 308	-	-	-
(b) Boeing 737	35 929	40 847	34 910	32 975	30 142	17 648	13 413
(c) Caravelle	1 410	2 309	3 413	9 390	17 984	21 687	15 170
(d) Viscount	-	-	418	1 117	1 592	1 872	5 881
(e) F-27	17 777	18 443	18 380	20 911	20 580	19 659	16 501
(f) HS-748	34 009	39 057	41 318	39 457	35 891	31 220	24 518
(g) Dakota	-	-	-	-	-	-	3 499
(h) Hind Aircraft	3 127	2 689	-	-	-	3 019	4 519
(i) Total In Revenue Hours	108 409	114 391	106 378	107 156	106 189	95 105	83 501
(j) Aircraft Hired Out	885	1 361	494	-	-	-	-
2 Revenue Kilometres (Million)	43 940	48 712	43 961	44 802	45 237	40 147	33 804
3 Available Tonne Kilometres (Million)	586 023	558 818	480 934	393 700	352 774	310 818	270 733
4 Revenue Tonne Kilometres (Million)	325 538	330 749	275 871	239 092	213 733	183 407	156 529
(a) Passenger	14 841	14 408	13 408	12 891	12 566	10 980	10 227
(b) Mail	48 379	45 809	35 681	25 741	22 564	18 513	17 782
(c) Cargo including Excess Baggage	398 558	390 464	324 958	277 524	248 863	212 900	184 538
(d) Total RTM	5720 379	5568 890	4808 472	4128 782	3870 635	3218 207	2700 725
5 Available Seat Kilometres (Million)	4199 140	4081 360	3388 804	2926 833	2609 180	2229 862	1904 458
6 Revenue Passenger Kilometres (Million)	768	749	712	700	-	-	-
7 Passenger Load Factor (%)	68.6	70.2	67.9	69.2	64.4	62.5	69.0
(a) A300B	89.5	83.2	80.8	74.1	71.7	72.8	72.4
(b) Boeing 737	-	-	55.5	54.1	50.3	48.3	55.7
(c) Caravelle	87.2	63.4	59.3	58.7	61.3	61.2	55.9
(d) Viscount	80.0	81.6	77.6	78.6	74.7	74.2	70.4
(e) F-27	-	-	-	-	-	-	59.8
(f) HS-748	73.4	73.3	70.5	70.9	67.4	69.3	70.5
(g) Dakota	-	-	-	-	-	-	-
(h) All Types	70.5	70.5	70.5	70.9	67.4	69.3	70.5

2	Ref. Point : Lat. 31°42'17"N Long. 74°48'11"E Site : 625M (2050 ft.) bearing 138° Geo from Intersection of Rwy.	1	City/Aerodrome: AMRITSAR/Amritsar
3	Distance and Direction from City : 6 NM bearing 325° Geo from Amritsar Rly. Station	16	Transportation Available : Airlines Buses and Taxis available at the airport and city.
4	Elevation : 229 M (752 ft.)	17	Cargo Handling Facilities:
5	Aerodrome Reference Temperature : 40.6°C (June)	18	Fuel Grades: TF K-50
6	Magnetic Variation : 1°E (1975)	19	Oil Grades: Nil
7	Transition Altitude : 1200 M (4000 ft.)	20	Oxygen and related Servicing : Nil
8	Operational Hours : HO and on request 4 hours notice to FIC Delhi.	21	Refuelling Facilities and Limitation: (a) 0900 to 1700 IST, 0330 to 1130 GMT (b) Other times 2 hours prior notice required. (c) Bowsers
9	Aerodrome Operator or Administrative Authority : Director General of Civil Aviation. New Delhi. Pin Code 110022.	22	Hangar Space Available for Visiting ACFT: Nil
10	Postal Address : Civil Aerodrome/Rajasaal AMRITSAR. Pin Code: 143101	23	Repair Facilities Normally Available: Nil
11	Telegraphic Address : (AFTN): VIARYD (Commercial): Aerodrome, Amritsar	24	Fire Protection : Required: Category: V Available: Category: IV Trained Personnel : 16 Facilities available for foaming of Runways: Nil
12	Telephone Numbers: ATC:) 45825 Aerodrome Officer) (Res) (Office)	25	Seasonal Availability : Aerodrome remains available and serviceable during all seasons.
13	Overnight Accommodation: No accommodation available at the airport. Adequate accommoda- tion available in the City Hotels.	26	Local Flying Restrictions: All Aeroplane. to maintain visual flight watch for Flying Club Aeroplanes and Gliders operating in Amritsar Aerodrome Traffic Circuit.
14	Restaurant Accommodation: Restaurant avail- able at the Aerodrome. Light refreshments. Sufficient meals available with prior arrange- ments with Restaurant.	27	Pre-Flight Altimeter Check Location(s) and Elevations: Not Established.
15	Medical Facilities : First aid treatment and Ambulance. Hospital in the city 6 NM.		

28	METEOROLOGICAL DATA											
Mean Daily Maximum and Minimum Temperatures (C)												
Temperature	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Maximum (a)	18.6	22.6	27.5	34.2	38.9	40.4	35.6	34.2	34.4	31.9	26.5	21.4
Minimum (b)	4.5	6.5	11.5	16.2	21.4	25.2	25.9	25.3	23.3	16.6	8.8	5.0
Monthly Mean Pressure in (MB) at approximately the times of maximum (a) and minimum (b) temperatures												
Maximum (a)	988.5	985.9	982.8	979.1	973.5	968.7	969.5	971.3	976.0	981.8	986.8	988.8
Minimum (b)	990.2	987.7	984.9	981.7	976.3	972.1	972.5	974.1	978.5	984.5	989.6	990.7
Absolute Humidity (G/M ³) at approximately the times of maximum (a) and minimum (b) temperatures												
Maximum (a)	8.41	8.20	9.58	8.11	8.51	12.69	21.52	22.43	18.49	13.08	8.94	8.05
Minimum (b)	7.04	7.84	10.05	10.87	11.10	15.38	21.79	22.68	19.90	14.04	9.13	7.04

29

SLOPES: LONGITUDINAL PROFILES OF RUNWAYS:



30

PHYSICAL CHARACTERISTICS

Runway		Dimensions (M)				Strength	Surface	
Designation	True BRG.	Runway	Stop-way	Clearway	Strip	Runway	Runway	Stop-way
a	b	c	d	e	f	g	h	i
07	067°	1402m x 30.5m	-	-	1524m x 122m	LCN 10/30@	Concrete	-
25	247°	4600ft. x 100 ft.	-	-	5000 ft. x 4000ft.			-
16	156°	2789m. x 46m.	-	122m x 152m. 400 ft. x 500 ft.	2911m. x 152m.	LCN-40	Concrete 2800 ft. from Rwy 16 & 1400 ft. from Rwy 34 beginning Remaining 4950 ft. Bitu- men Surface.	-
34	336°	9150ft. x 150ft.	-	244m. x 152 m. 800ft. x 500ft.	9550ft. x 500ft.			-

Remarks:

- 1) Rwy 07/25 closed for aircraft operation UFN. To be used for taxiing only.
- 2) Belly landing strip dimensions 3000 ft. x 150 ft. available to the starboard of Rwy 34 upto intersections of Rwys.

@ LCN 30 from beginning of Rwy 25 upto intersection and LCN-10 from intersection to Rwy 25 end.

31

MOVEMENT AREAS

Aprons: 136 m. x 72 m. (445 ft. x 235 ft.)

Taxiways: Width 15 m. (50 ft.)

Surface: Concrete LCN 30

Surface: Concrete. LCN 30

Helicopter Alighting Areas: Not established.

VISUAL GROUND AIDS										
32	Taxying Guidance Systems: Taxying guidance given on RT.									
33	Visual Aids to Location: ABN FLG W & C Aerodrome Identification Sign.									
34	Indications and Ground Signalling Devices: WDI Lighted LDI) Signal Area) Not Lighted									
35	Lighting Aids									
Approach Lighting: NIL					Runway Lighting: Rwy 16/34 Edge, Threshold and End lights. High Intensity. Omni and bi-directional. Rwy 07/25 Edge, Threshold and End lights. Cone Type. Taxiway Lights: Available Other Lights: Apron flood lights - A'drome beacon.					
36	Emergency Lighting and Secondary Power Supply: Paraffin flares available. Secondary Power Supply available. Maximum switch over time - Eight Seconds.				37	Obstruction Marking and Lighting: All operationally significant obstructions are lighted and marked.				
38	Marking Aids: Threshold, Designation Numbers, Centre line and Side Strips.									
39	OBSTRUCTIONS IN APPROACH AND TAKE-OFF AREAS									
	RWY	TYPE	ELEV (M)	FROM RWY THRESHOLD		RWY	TYPE	ELEV (M)	FROM RWY THRESHOLD	
	a	b	c	DIST (M)	MAG	a	b	c	DIST (M)	MAG
(This information is depicted in Aerodrome Obstruction Chart)										
ICAO (TYPE A)										
REMARKS:										
Declared Distances:			RWY	TORA M	ASDA M	TODA M	LDA M	40		
			16	2789	2789	2911	2687	NIL		
			34	2789	2789	3033	2586			
41	DISABLED AIRCRAFT REMOVAL: CAPACITY: NIL									

2	Ref. Point: Lat. 22 39 11N Long. 88 26 57E Site: Near PAR building.	1	City/Aerodrome: CALCUTTA/Calcutta.
3	Distance and Direction from City: 8 NM. Brg. 045 deg. Geo. from Howrah (Calcutta) Rly. Station.	18	Fuel Grades: All grades of aviation fuel including turbine fuel and fluid-water methanol. Note: AVGAS 115/145 not available, for foreign acft. only.
4	Elevation: 5M (17.5 ft.)	19	Oil Grades: All grades of aviation oil including Turbine and hydraulic oil.
5	Aerodrome Reference Temperature: 35.7 deg. C. (May)	20	Oxygen and Related Servicing: Nil
6	Magnetic Variation: 0° 46'W (1975).	21	Refuelling Facilities and Limitations: (a) H24 (b) No. PN (c) Hydrant and bowers.
7	Transition Altitude: 600M (2000 ft.)	22	Hangar Space Available for Visiting Acft: Hangar accommodation available.
8	Operational Hours: H24	23	Repair Facilities Normally Available: Available with local airline operators.
9	Aerodrome Operator or Administrative Authority: International Airport Authority of India, New Delhi FOR ATS, AFTN) Director General of Civil and Nav Aids. Aviation, New Delhi.	24	Fire Protection: Maintaining CAT VIII Water capacity required in Foam Crash Fire Tender - 13640 ltrs. Water capacity available in Foam Crash Fire Tender - 18190 ltrs.
10	Postal Address: Calcutta Aerodrome, Calcutta 52.	25	Seasonal Availability: Aerodrome serviceable during all seasons.
11	Telegraphic Addresses: (AFTN): VECCYD (COMMERCIAL): Aerodrome Calcutta.	26	Local Flying Restrictions: All aircraft to avoid overflying Barrackpore aerodrome (2247N 8821E) at or below FL 35 and radius 4 NM and Behala aerodrome (2230N 8818E) at or below 1000 ft. and Radius 1 NM.
12	Telephone Numbers: I. A. A. I. - Airport Director (Office) - 573181 (Res.) - 573172 Airport Dy. Director (Office) - 573354 (Res.) - 573172 Controller of Aerodrome (Office) - 573455, 572611/270 (Res.) - 573455 Aerodrome Control Tower - 572611/276 F. I. C. 572123, 572611/277 APP 572998, 572611/279 Advisory Unit 572611/278 A. T. C. Briefing 572429, 572611/283 & 284	27	Pre-flight Altimeter Check Point(s) and Elevation: Not established.
13	Overnight Accommodation: Rest rooms at airport, hotels at airport and in city.		
14	Restaurant Accommodation: Restaurants, all types of meals served.		
15	Medical Facilities: First aid treatment, rest room and ambulance. Hospital in the city 4 NM.		
16	Transportation Available: Taxis.		
17	Cargo Handling Facilities: Available with local airline operators.		

METEOROLOGICAL DATA

Mean Daily Maximum and Minimum Temperatures (C)

Temperature	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Maximum (a)	26.4	29.0	33.8	36.0	35.7	33.8	31.8	31.8	32.0	31.4	29.0	26.5
Minimum (b)	12.3	15.1	20.4	24.3	26.0	26.2	26.0	26.0	25.9	23.6	17.6	13.0

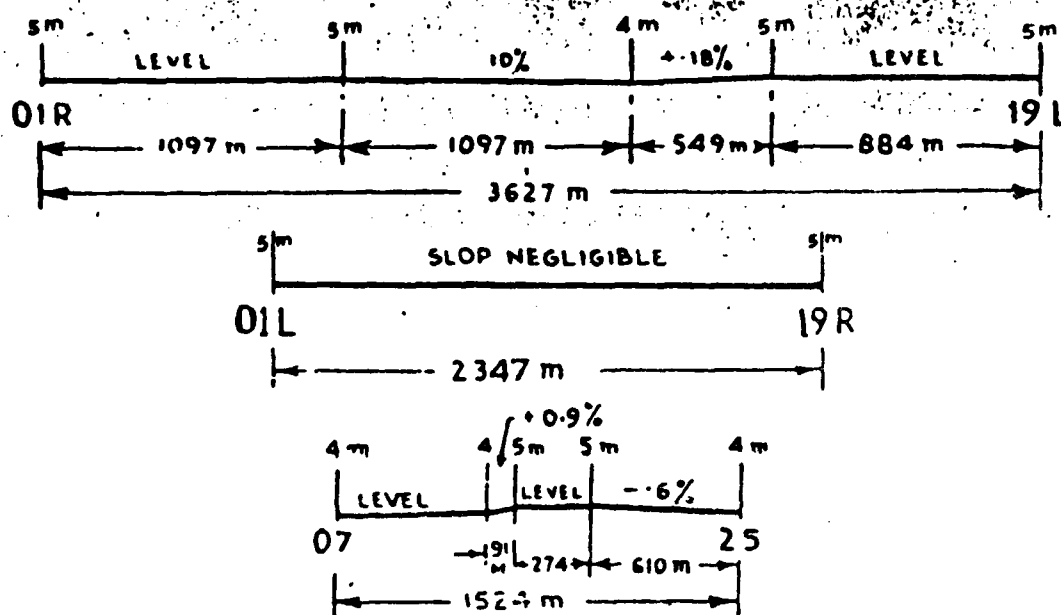
Monthly Mean Pressure in (MB) at approximately the times of maximum (a) and minimum (b) temperatures

Maximum (a)	1013.2	1010.5	1007.1	1003.7	999.9	996.7	996.8	998.3	1001.5	1007.3	1010.9	1012.9
Minimum (b)	1016.8	1014.1	1011.2	1008.0	1003.8	999.8	999.6	1001.3	1004.9	1010.5	1014.2	1016.3

Absolute Humidity (G/M³) at approximately the times of maximum (a) and minimum (b) temperatures

Maximum (a)	11.32	12.00	14.66	18.78	22.85	23.87	23.54	23.57	23.03	20.61	15.23	12.23
Minimum (b)	11.10	12.67	16.67	20.23	23.51	23.97	23.60	23.44	23.28	20.08	14.47	11.59

29 Slopes : Longitudinal Profiles of Runways :



30

PHYSICAL CHARACTERISTICS

Runway		Dimensions (M)				Usable Strength	Surface	
Designation	True Brg.	Runway	Stopway	Clearway	Strip	Runway	Runway	Stopway
a	b	c	d	e	f	g	h	i
19L 01R	186 006	3627M x 46M 11900ft x 150 ft	61M x 46M 200 ft. x 150 ft. Nil	152M x 305M 500 ft. x 1000 ft. Nil	3749M x 305M 13300 ft. x 1000 ft.	LCN 70	-	-
19R 01L	186 006	2347M x 46M 7700 ft. x 150 ft.	152M x 46M 500 ft. x 150 ft. 152M x 46M 500 ft. x 150 ft.	152M x 305M 500 ft. x 1000ft.	2476M x 305M 8124 ft. x 1000 ft.	LCN 30	-	-
07	067 247	1524M x 46M 5000 ft. x 150 ft.	Nil	Nil	1646M x 152M 5400 ft. x 500 ft.		-	-

Remarks: (1) Rwy 07/25 not usable for operations.
 (2) Runway 19L Threshold Displaced by 427M (1400 ft) Displaced Threshold suitably Marked for Day & Night Operations.

(3) Adjacent domestic Aerodrome Barrackpore Rwy 20/02 distance 9NM bearing 328° from Calcutta Airport.

31

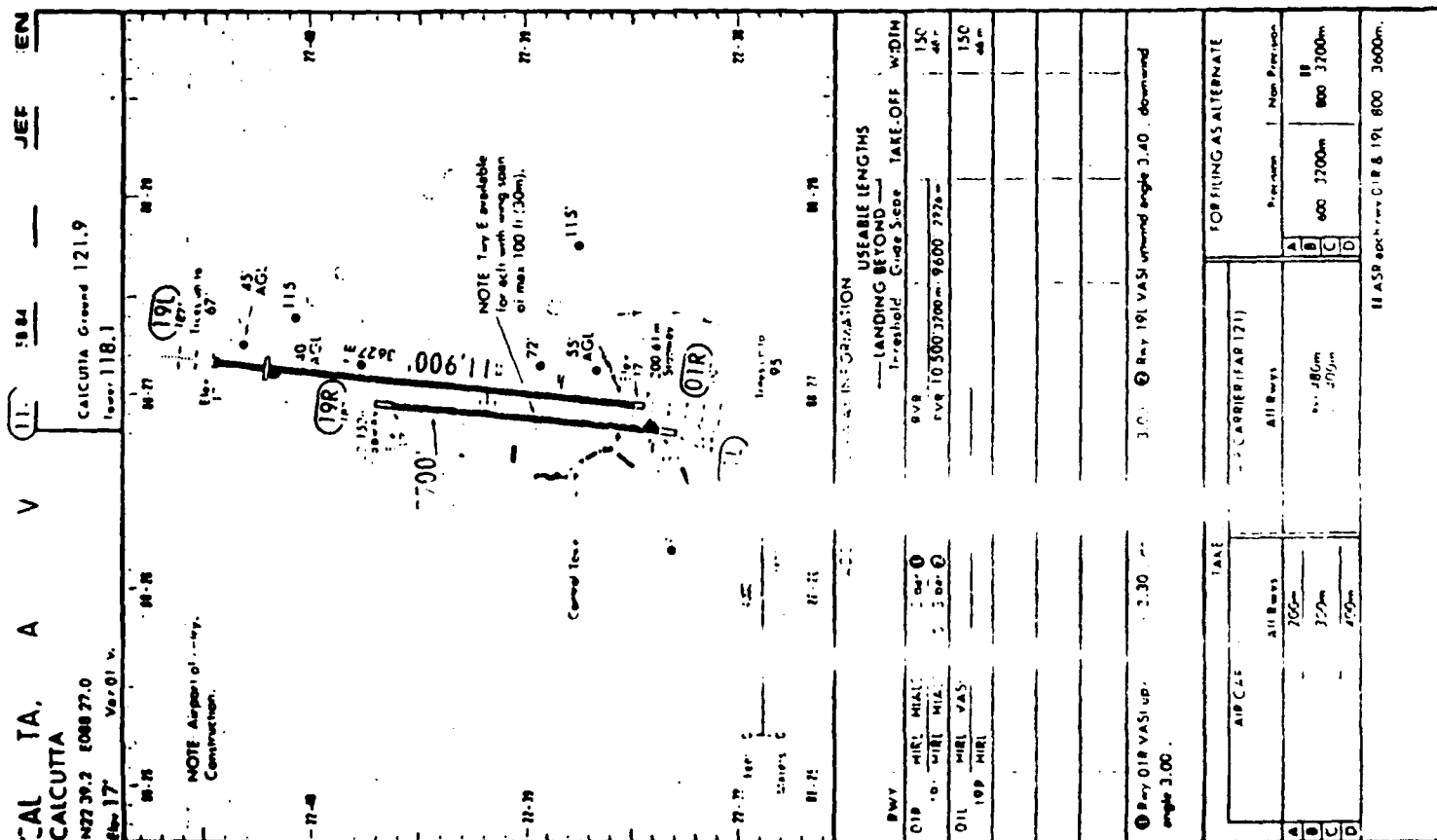
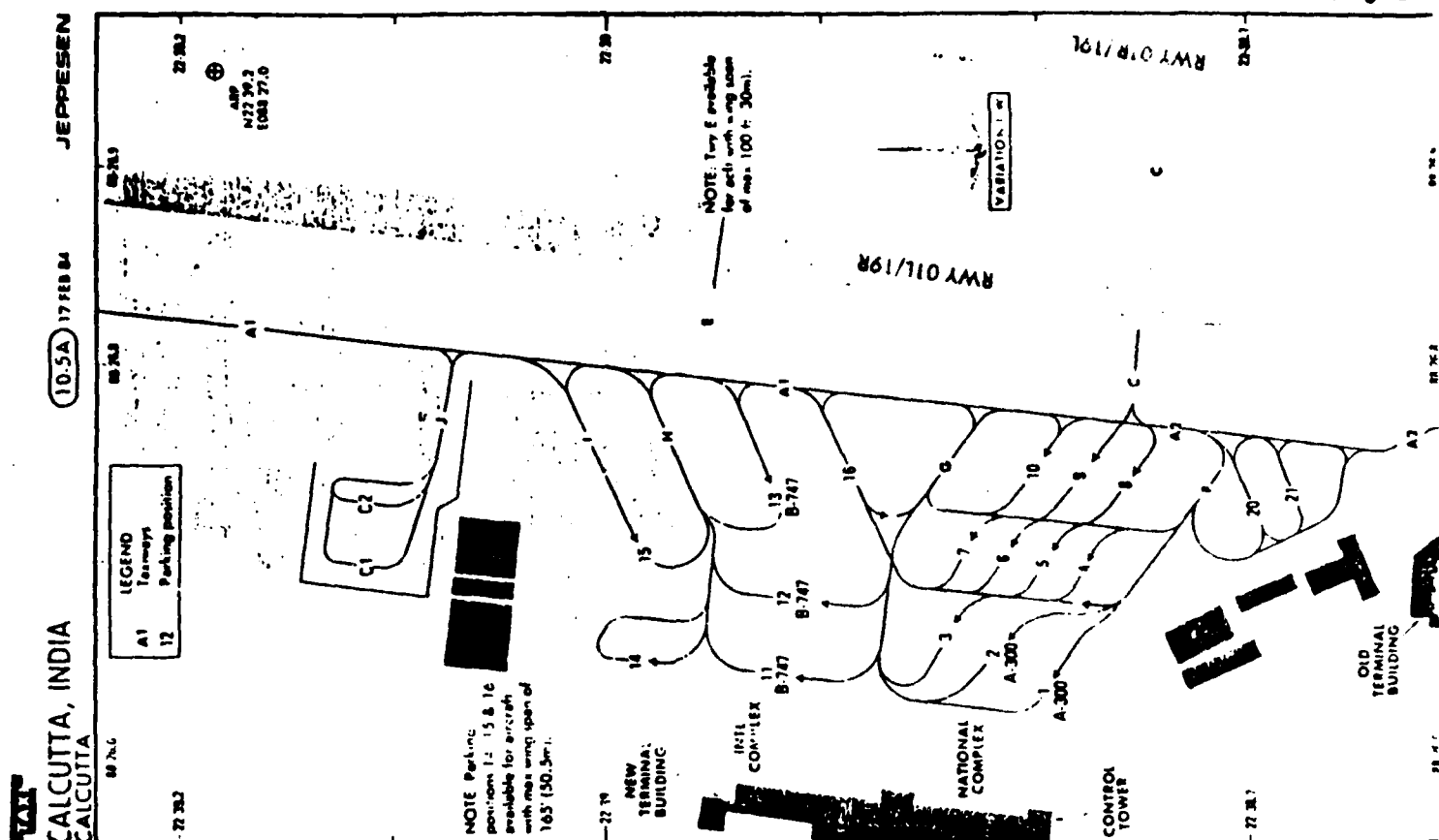
Movement Areas

Aprons: 914.5M (3000 ft.) x varying from 122M (400 ft.) to 305M (1000 ft.)
 Surface: Cement concrete.

Taxiways: 1) Perimeter Taxiway: Taxiway Alpha width 22.5M (75 ft.)
 2) Taxiway North of PAR Building : Taxiway Bravo width 22.5M (75 ft.)
 3) Central Taxiway : Taxiway Charlie width 22.5M (75 ft.)
 4) Taxiway leading to Rwy 01L and 01R : Taxiway Delta width 46M (150 ft.)
 Surface: Cement Concrete

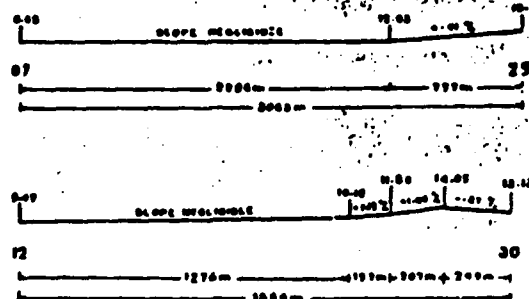
Helicopter Alighting Areas: Not established.

VISUAL GROUND AIDS																																											
Taxying Guidance Systems: Taxying guidance given on R/T.																																											
33	Visual Aids to Location ABN-Fig W & G: IBN-Fig G "EA": Identification sign.																																										
34	Indicators and Ground Signalling Devices: LDI-Lgtd; WDI-Lgtd; Signal area-Not Lgtd.																																										
35	Lighting Aids.																																										
<p>Approach Lighting: Simple approach lighting consisting of 2 rows of 12 unidirectional lights commencing 200 ft from and extending upto 1400 ft. from displaced THR Rwy 19L placed along both edges of Rwy showing Red in the approach direction with a cross bar consisting of 10 unidirectional lights each on both sides of the Rwy at 1000 ft. from displaced THR of Rwy 19L showing white in the approach direction. Intensity variable in stages.</p> <p>Note: Approach lighting system for Rwy 01-R, 1300 ft. only available UFN.</p>					<p>Runway Lighting: RWY 01R/19L: Edge, Threshold and End lights (High Intensity) RWY 01L/19R Edge, Threshold and end lights (medium intensity)</p> <p>Other Lighting: Taxiway lights, Apron flood lights, Turning pad lights.</p> <p>Lead in Light: On Rwy 19R & 01L</p> <p>Vaxis: Rwy 01R with 3° Glide slope setting and variable intensity.</p>																																						
36	Emergency Lighting: Paraffin flares.				37 Obstruction Marking and Lighting: All operational-ly significant obstructions are not lighted and marked.																																						
38	Marking Aids: Threshold, designation numbers, centreline-all runways. Taxi holding position, centre line-all taxiways.																																										
39	Obstructions in Approach and Take-off Areas																																										
<table border="1"> <thead> <tr> <th rowspan="2">Rwy</th> <th rowspan="2">Type</th> <th rowspan="2">Elev (M)</th> <th colspan="2">From Rwy Threshold</th> <th rowspan="2">Rwy</th> <th rowspan="2">Type</th> <th rowspan="2">Elev (M)</th> <th colspan="2">From Rwy Threshold</th> </tr> <tr> <th>Dist(M)</th> <th>Mag</th> <th>Dist(M)</th> <th>Mag</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td colspan="10">This information is depicted in Aerodrome obstruction chart ICAO(Type A)</td> </tr> </tbody> </table>										Rwy	Type	Elev (M)	From Rwy Threshold		Rwy	Type	Elev (M)	From Rwy Threshold		Dist(M)	Mag	Dist(M)	Mag	a	b	c	d	e	a	b	c	d	e	This information is depicted in Aerodrome obstruction chart ICAO(Type A)									
Rwy	Type	Elev (M)	From Rwy Threshold		Rwy	Type	Elev (M)	From Rwy Threshold																																			
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This information is depicted in Aerodrome obstruction chart ICAO(Type A)																																											
Remarks :																																											
<table border="1"> <thead> <tr> <th rowspan="2">Declared Distances</th> <th rowspan="2">RWY</th> <th>TORA</th> <th>ASDA</th> <th>TODA</th> <th>LDA</th> </tr> <tr> <th>M</th> <th>M</th> <th>M</th> <th>M</th> </tr> </thead> <tbody> <tr> <td></td> <td>19L</td> <td>3627</td> <td>3688</td> <td>3779</td> <td>3779</td> </tr> <tr> <td></td> <td>01R</td> <td>3627</td> <td>3688</td> <td>3779</td> <td>3627</td> </tr> <tr> <td></td> <td>19R</td> <td>2347</td> <td>2499</td> <td>2499</td> <td>2347</td> </tr> <tr> <td></td> <td>01L</td> <td>2347</td> <td>2499</td> <td>2499</td> <td>2347</td> </tr> </tbody> </table>										Declared Distances	RWY	TORA	ASDA	TODA	LDA	M	M	M	M		19L	3627	3688	3779	3779		01R	3627	3688	3779	3627		19R	2347	2499	2499	2347		01L	2347	2499	2499	2347
Declared Distances	RWY	TORA	ASDA	TODA	LDA																																						
		M	M	M	M																																						
	19L	3627	3688	3779	3779																																						
	01R	3627	3688	3779	3627																																						
	19R	2347	2499	2499	2347																																						
	01L	2347	2499	2499	2347																																						



2	Ref. Point : Lat. 12°59'37" Long. 80°10'37"E Site : 527 m. bearing 272° Geo from intersection of Rwy.	1	City/Aerodrome : MADRAS/Madras									
3	Distance and Direction from City : 7.6 NM bearing 228° Geo from Madras Central Railway Station.	18	Fuel Grades: PF 73, 100/130 Limited Stock. TF sufficient stock. Field Water Methanol.									
4	Elevation : 10.5 m.	19	Oil Grades: Turbine oil available. W. 120 limited stock. ASTO-390 for Turbine oil for Scheduled Operators only.									
5	Aerodrome Reference Temperature: 37.6° (May)	20	Oxygen and Related Servicing: Available on prior arrangements with Airlines.									
6	Magnetic Variation : 2°10' W (1975)	21	Refuelling Facilities and Limitation : (a) H24 (b) No PN (c) Bowsers.									
7	Transition Altitude : 1200m. (4000 ft.)	22	Hangar Space available for visiting ACFT : No Hangar accommodation is specifically reserved for visiting Aeroplanes. Aerodrome Officer may be contacted for availability of Hangar accommodation.									
8	Operational Hours : H 24	23	Repair Facilities normally available: Available with Local Airline operators.									
9	Aerodrome Operator or Administrative Authority : International Airport Authority of India, New Delhi. For ATS, AFTN) Director General of Civil & NAVAIDS) Aviation, New Delhi-110022.	24	Fire Protection : Required: Category: VII Available: Category: VIII Trained Personnel: 46 Facilities available for foaming of Runways :									
10	Postal Address : Madras Airport, Madras-600 027.	25	Seasonal Availability : Airport available in all seasons.									
11	Telegraphic Address : (AFTN) : VOMMYD (Commercial) : Aerodrome Madras	26	Local Flying Restrictions: All aeroplanes to maintain Visual Flight Watch for Flying Club Aeroplanes flying over and in the vicinity of Tambaram Aerodrome located 6 NM 213° Geo from Madras Airport. Flights are to be undertaken with prior ATC clearance from Madras Airport and in compliance with instructions received.									
12	Telephone Numbers: ATC: 432231 Controller of) Res: 431634 Aerodromes) Office: 431740 Director, IAAI : Res: 411376 Office: 433062	27	Pre-Flight Altimeter Check Location(s) and Elevations : Not established.									
13	Overnight Accommodation : Limited. 10 Beds. 4 double rooms and 2 single rooms available at Airport. Hotels available in the city.											
14	Restaurant Accommodation : Refreshments available at the airport restaurant. Meals available on one hour's notice or prior arrangements.											
15	Medical Facilities : First aid treatment, Rest rooms & Ambulance. Hospitals in the city.											
16	Transportation Available : Taxis, Electric Trains, City Bus, PTC and Tourist Couch.											
17	Cargo Handling Facilities : Cargo Complex, Domestic and International Cargo facility available.											
28	METEOROLOGICAL DATA											
Mean Daily Maximum and Minimum Temperatures (C)												
Temperature	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Maximum (a)	28.8	30.6	32.7	34.9	37.6	37.3	35.2	34.5	33.9	31.8	29.4	28.2
Minimum (b)	20.3	21.1	23.1	26.0	27.8	27.6	26.3	25.8	25.4	24.4	22.5	21.0
Monthly Mean Pressure in (MB) at approximately the times of maximum (a) and minimum (b) temperatures												
Maximum (a)	1010.5	1009.5	1007.1	1004.3	1000.8	999.9	1000.7	1001.1	1002.4	1005.3	1008.1	1010.0
Minimum (b)	1013.6	1012.2	1010.6	1008.4	1004.5	1003.5	1004.2	1004.9	1006.3	1008.5	1010.9	1012.9
Absolute Humidity (G/M ³) at approximately the times of maximum (a) and minimum (b) temperatures												
Maximum (a)	16.50	16.68	18.80	21.78	22.78	20.80	20.06	20.60	21.28	21.37	19.14	17.01
Minimum (b)	17.56	18.12	19.94	21.73	20.70	18.58	18.99	19.61	20.53	21.56	19.88	18.39

29 SLOPES : LONGITUDINAL PROFILES OF RUNWAYS:



30 PHYSICAL CHARACTERISTICS								
Runway		Dimensions (M)				Strength	Surface	
Designation	True BRG.	Runway	Stop-way	Clearway	Strip	Runway	Runway	Stop-way
a	b	c	d	e	f	g	h	i
12	119	1884m. x 46M.	-	-	2006m. x 152m.	LCN-20	Partly concrete and partly Bitumen.	-
30	299		-	-				-
07	069-30	3063m. x 46m	-	153m.	3185m. x 305m.	LCN-100	Bitumen	-
25	249-30		-	183m.				-

Remarks : 1) Rwy 12/30 not available for aircraft exceeding on AWW 20,000 kg. Available for take-off and landing by day and night subject to 15 minutes clear notice for Rwy 30 at night to enable lighting the Rwy Threshold.
 2) Rwy 30 Threshold displaced by 279m. due mobile obstruction on Highway.
 3) Rwy 12/30 length reduced by 75 ft. due to fencing at Rwy 30 End.
 4) Adjacent domestic Aerodrome Tambaram Rwy 05/23 and 12/30 distance 6 NM bearing 213° from Madras Airport.

31 MOVEMENT AREAS	
Aprons : 1) 5.2 Hectares for light and medium aircraft. 2) 15,968m ² with LCN. 60 3) 13,000m ² being upgraded to LCN 60. Surface :	Taxiways: 1) Width 23m LCN60 shoulders 12'6" on either Side. 2) Link Taxi-Track. LCN. 30-60 Surface : 3) Western parallel Taxi-Track LCN 100.

Helicopter Alighting Areas : Not established.

VISUAL GROUND AIDS									
32	Taxying Guidance Systems: Taxying guidance given on Radio Telephone and follow me Jeep facility on request.								
33	Visual Aids to Location: ABN FLA W&C IDENTIFICATION SIGN.								
34	Indications and Ground Signalling Devices: LDI) WDI) Lighted Signal Area : Unlighted								
35	Lighting Aids								
Approach Lighting: Rwy/07 CALVERT app. lighting up to 2300 ft. with cross bars at every 500 Ft. Rwy 25 - Simple Approach lighting. VASIS: Rwy 25 3° Angle setting 3 bar & 3.3° Rwy 07 2.75° Angle setting 3 bar & 3.05°.					Runway Lighting: Rwy 07/25 & 12/30 EDGE. THRESHOLD and END Lights. High Intensity. Taxiway Lights: Available. Other Lights: Apron Flood Lights at Rwy07 End.				
36	Emergency Lighting and Secondary Power Supply: Paraffin Flares Available. Secondary Power Supply available, maximum switch over time 15 seconds.				37	Obstruction Marking and Lighting: All operationally significant obstructions are lighted and marked.			
38	Marking Aids: Threshold - Designation Numbers - Centre Line - Touch Down ZONE markings: All Runways. Taxi Holding Position - Taxiway Centre Line: All Taxiways.								
39	OBSTRUCTIONS IN APPROACH AND TAKE-OFF AREAS								
	RWY	TYPE	ELEV (M)	FROM RWY THRESHOLD		RWY	TYPE	ELEV (M)	FROM RWY THRESHOLD
				DIST (M)	MAG				DIST (M) MAG
	a	b	c	d	e	a	b	c	d e
(This information is depicted in Aerodrome Obstruction Chart - ICAO (TYPE A))									
REMARKS:									
Declared Distances:		RWY	TORA M	ASDA M	TODA M	LDA M	40		
		07	3063	3063	3216	3063	NIL		
		25	3063	3063	3246	3063			
		12	1884	1884	1884	1884			
		30	1884	1884	2067	1605			
41	DISABLED AIRCRAFT REMOVAL: CAPACITY: Arrangements with Local Air-Lines.								
Remarks: Also see page 2.21.1 & 2.21.3									

Appendix C: Civilian Airports

(Page 3D)

MADRAS, INDIA

VOMM

11 1 20 JAN 84

JEPPESEN

MADRAS INTL

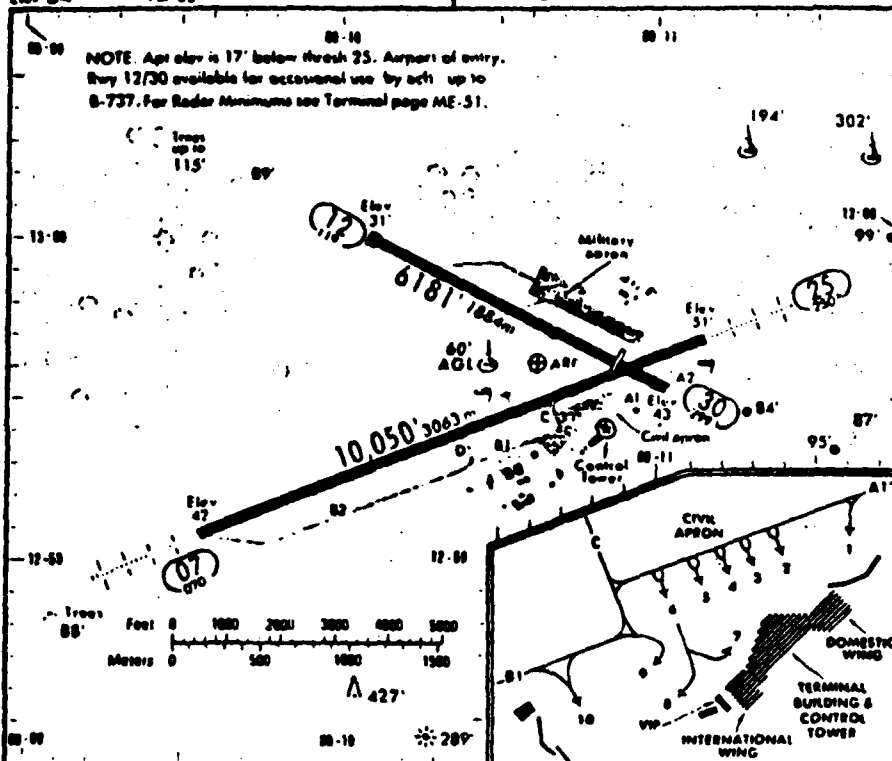
M12 39.6 E080 10.6

Elev 34'

Var 02° W

MADRAS Ground 121.9

Tower 118.1



ADDITIONAL RUNWAY INFORMATION

RWY		USEABLE LENGTHS			WIDTH
		LANDING BEYOND Threshold	Glide Slope	TAKE-OFF	
07	MIRL NIALS (3 bar) VASI (3 bar)	RVR	9050 2758 m		151' 46 m
25	MIRL NIALS (3 bar) VASI (3 bar)				
12	MIRL	5827' 1776m		6132' 1869m	151' 46 m
30		(5) 5282' 1610m			

- ① Landing at night O/R 15 min.
- ② Upwind angle 3.25 . downwind angle 3.0 .
- ③ Upwind angle 3.0 . downwind angle 2.75 .

TAKE-OFF				FOR FILING AS ALTERNATE		
AIR CARRIER		AIR CARRIER (FAR 121)		15 1500 ft 30 1000 ft		
A B C D	All Runways	7 ft 1.8 m	All Runways	A B C D	400	800
	200m		ave 480m		3200m	900
	300m		400m		3200m	3200m
	400m				88	88

11 ASR Aprch 800' 3600m.
11 C 900 4000m, D 900 4400m.

Appendix C: Civilian Airports

(Page 4A)

2	Ref. Point: Lat. 08°28'40"N Long. 76°55'15"E Site: 370.5m Bearing 283°Geo from intersection of Rwy 14/32 and 10/28	1	City/Aerodrome: TRIVANDRUM/Trivandrum
3	Distance and Direction from City: 2 NM Bearing 261°Geo from Trivandrum Railway Stn.	18	Fuel Grades: PF 80 TF K. 50
4	Elevation: 4 m.	19	Oil Grades: NIL
5	Aerodrome Reference Temperature: 32.6°C (April)	20	Oxygen and Related Servicing: NIL
6	Magnetic Variation: 3°10' W (1975)	21	Refuelling Facilities and Limitation: (a) HO (b) 2 hours PN (c) Bowers
7	Transition Altitude: 2400m (8000 ft.)	22	Hangar Space available for visiting ACFT: SWP Hangar available.
8	Operational Hours: HO	23	Repair Facilities normally available: NIL
9	Aerodrome Operator or Administrative Authority: Director General of Civil Aviation, New Delhi, Pin Code: 110 022.	24	Fire Protection: Required: Category V Available: Category IV Trained Personnel: 17 Facilities available for foaming of Runways: NIL
10	Postal Address: Civil Aerodrome, Trivandrum, Pin Code: 695 006	25	Seasonal Availability: Aerodrome remains serviceable during all seasons.
11	Telegraphic Addresses: (AFTN): VOTVYD (Commercial): Aerodrome Trivandrum	26	Local Flying Restrictions: All aeroplanes to maintain visual flight watch for flying Club aeroplanes operating from and flying in the vicinity of Trivandrum Aerodrome.
12	Telephone Numbers: ATC: 2224 Aerodrome Officer (Res) 4572 (Office) 5022	27	Pre-flight Altimeter Check Location(s) and Elevations: Not established.
13	Overnight Accommodation: Nil at Aerodrome. Accommodation available in City Hotels.		
14	Restaurant Accommodation: Restaurant available. Light refreshments served.		
15	Medical Facilities: First aid treatment and Ambulance. Hospital in City - 2001.		
16	Transportation available: Taxis available at the Airport.		
17	Cargo Handling Facilities: Available with Local Airline Operators.		

METEOROLOGICAL DATA

Mean Daily Maximum and Minimum Temperatures (C)

Temperature	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Maximum (a)	30.7	31.3	32.1	32.6	31.7	30.0	29.3	27.2	29.6	29.6	30.3	30.4
Minimum (b)	21.4	22.1	23.8	25.1	25.1	23.9	23.5	23.4	23.6	23.5	23.2	22.7

Monthly Mean Pressure in (Mb) at approximately the times of maximum (a) and minimum (b) temperatures

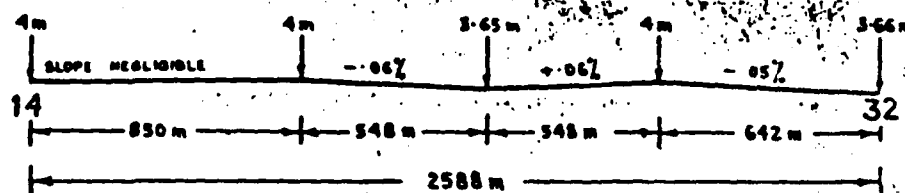
Maximum (a)	1009.1	1008.4	1007.5	1005.6	1005.3	1006.3	1006.4	1006.4	1006.6	1006.8	1008.2	1008.4
Minimum (b)	1012.0	1011.7	1010.9	1009.5	1008.5	1008.7	1009.0	1009.4	1009.9	1010.5	1011.2	1011.3

Absolute Humidity (G/M³) at approximately the times of maximum (a) and minimum (b) temperatures

Maximum (a)	17.89	17.93	20.01	21.86	21.68	21.59	20.74	20.49	20.72	21.12	20.08	18.85
Minimum (b)	16.95	17.49	19.65	21.21	21.70	21.41	20.60	20.59	20.67	20.67	19.47	18.45

29

SLOPES: LONGITUDINAL PROFILES OF RUNWAYS STOPWAYS AND CLEARWAYS:



30

PHYSICAL CHARACTERISTICS

Runway		Dimensions (M)				Strength	Surface	
Designation	True BRG.	Runway	Stop-way	Clearway	Strip	Runway	Runway	Stop-way
a	b	c	d	e	f	g	h	i
14	136°	2588m x 46m.	-	-	2710m x 152m.	LCN-40	Asphalt Concrete	
32	316°		-	640m x 152m.				
10	096°	1224m x 37m.	-	-	1346m x 152m.		Concrete	
28	276°		-	-				
05	045°	984m x 37m.	-	229m x 152m.	1106m x 152m.		Concrete	
23	225°		-	Nil				

Remarks:

- 1) 8m wide shoulders provided on either side of Rwy 10/28.
- 2) Rwy 10/28 full paved length is 1343m. but Basic strip of 152m. width available for 1224m only.
- 3) Threshold of Rwy 32 displaced by 58m.
- 4) Rwy 05/23 full paved length is 1094m. but Basic strip of 152m. width available for 984m only.

31

MOVEMENT AREAS

Aprons: 1) 43m x 34 m.
 2) 46m x 40m.
 3) 91.5m x 76m.

Surface: Concrete

Taxiways: Width 23m.

Surface: Concrete

Helicopter Alighting Areas: Not established.

VISUAL GROUND AIDS									
32	Taxying Guidance Systems: Taxying guidance given on R/T.								
33	Visual Aids to Location: ABN FLG W&G IDENTIFICATION SIGN								
34	Indications and Ground Signalling Devices: LDI : Lighted. WDI : Unlighted Signal Area :								
35	Lighting Aids :								
Approach Lighting: 1					Runway Lighting: WHITE-Uni directional Last 609.5 m. AMBER. RWY 14/32 - Medium Intensity Lighting System with variable Intensity. Threshold Lights: Green Omnidirectional Taxiway Lights and Turning Pad Lights: BLUE Other Lights: Apron Flood Lights-A'drome Beacon				
VASI installed on approach to Rwy 32. Angle 2.75"									
Emergency Lighting: Secondary Power Supply: 1. Primary Power: 2. Secondary Power: 3. Switch over time.					37	Obstruction Marking and Lighting: Some of the operationally significant obstructions are not lighted and marked.			
38	Marking Aids: 1. Side strip markings: 2. Fixed Distance Markings Rwy 14/32 3. Taxiway Holding Position) All Rwys. 4. Taxiway Centre Line) All Taxiways.								
39	OBSTRUCTIONS IN APPROACH AND TAKE-OFF AREAS								
RWY	TYPE	FROM RWY THRESHOLD	RWY	TYPE	ELEV (M)	FROM RWY THRESHOLD			
	b	DIST (M)		b	c	DIST (M)	MAG		
		c	a		d		e		
0	Building (Palace)	286°	23	Trees	68.8	3146	047°		
1		267°	28	Trees	37.19	426.72	104°		
REMARKS:									
Declared Distances:		10RA M	ASDA M	TODA M	LDA M	40			
		2588	2588	2588	2588	NIL			
		2588	2588	3228	2530				
41	DISABLED AIRCRAFT REMOVAL: CAPACITY:								
Following Equipment is available with Vikram Sarabhai, Space Control, Trivandrum :- Coles Crane : Capacity 5 Tons on wheels and 12 Tons on Jack - 1 Number. Fork Lift : Capacity 8 Tons - 4 Numbers. Trolleys : Capacity 5 Tons, Length 5 Metres - 1 Number. Satellite Loading Vehicle Capacity 12 Tons, Length 12 Metres, - 1 Number (Available only when stationed at TRIVANDRUM).									

Appendix C: Civilian Airports

(Page 4D)

TRIVANDRUM, INDIA

VOTV (11-1) 23 SEP 83

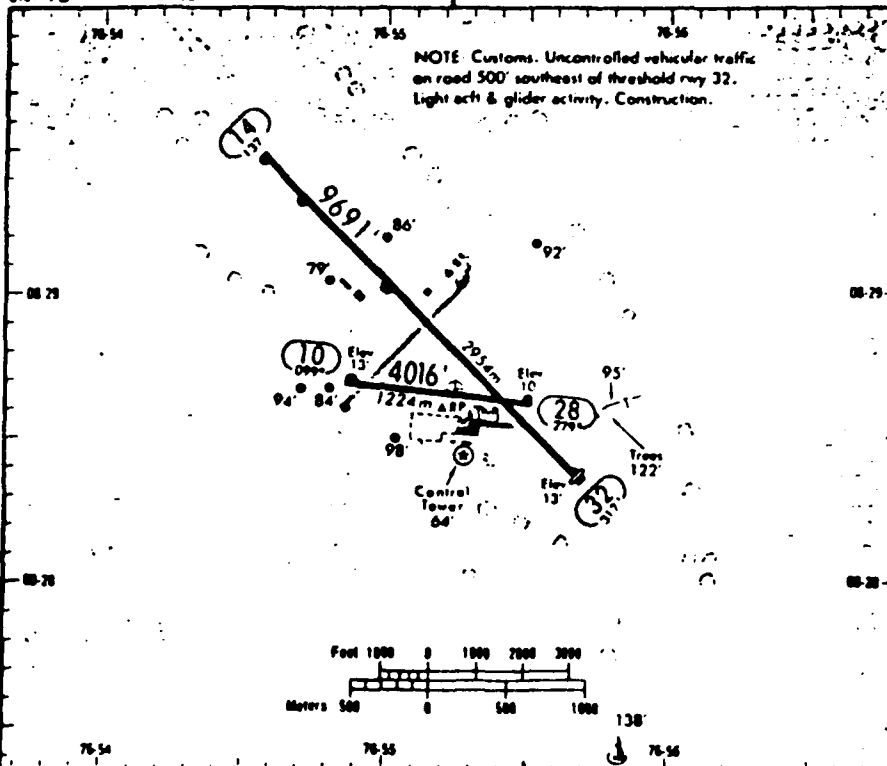
JEPPESEN

TRIVANDRUM APT.

M06 25.7 E076 55.3

Elev 13' Var 03°W

TRIVANDRUM Tower 118.1
(OP NOT CONT)



ADDITIONAL RUNWAY INFORMATION

RWY		USEABLE LENGTHS			WIDTH
		LANDING BEYOND Threshold		TAKE-OFF	
14	MIRL				151'
32	MIRL AVAST (3 02)	9500'	2896m	8550'	260m
10	Flare pots in emergency.				121'
28					27m

TAKE-OFF

AIR CARRIER	
	All Rwy's
A	200m
B	300m
C	400m

FOR FILING AS ALTERNATE

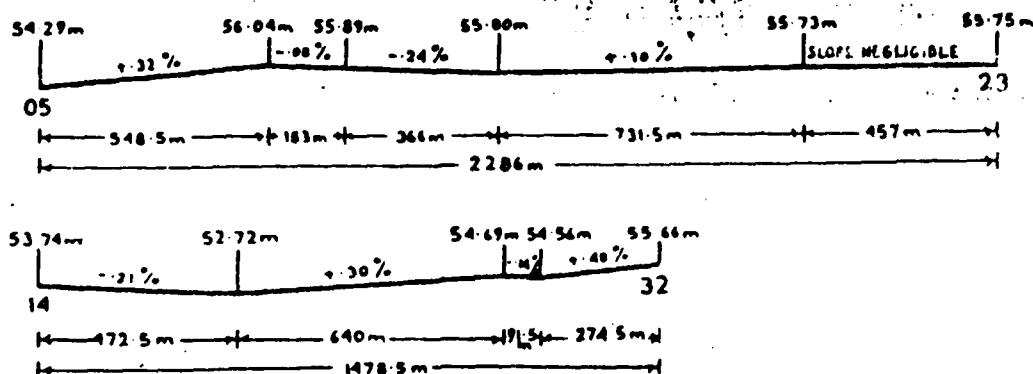
	Precision	Non-Precision
A		
B	600' 7200m	800' 3200m
C		
D		

■ VOR opch rwy 14 AB 900' 3200m.
C 900' 4400m.
D 900' 4800m.

2	Ref. Point: Lat. 230414N Long. 723737E Site: 527M (1730 ft.) Brg. 033 deg. Geo from Intersection of runways.	1	City/Aerodrome: AHMADABAD/Ahmadabad.									
3	Distance and Direction from City: 4.4 NM, Brg. 045 deg. Geo. from Ahmadabad Railway Station.	18	Fuel Grades: AVG : 100/130 ATF: K50 Methanol mixture - Nil.									
4	Elevation: 55 M (180 ft.)	19	Oil Grades: Nil									
5	Aerodrome Reference Temperature: 40.7°C (May)	20	Oxygen and Related Servicing: Nil									
6	Magnetic Variation: 0°45'W (1975)	21	Refuelling Facilities and Limitations: (a) 0130 to 1200 GMT only except in emergency.									
7	Transition Altitude: 510M (1700 ft.)	22	Hangar Space Available for Visiting Acft: Nil.									
8	Operational Hours: H 24	23	Repair Facilities Normally Available: Nil.									
9	Aerodrome Operator or Administrative Authority: Director General of Civil Aviation, New Delhi.	24	Fire Protection: Required: Category V Available: Category IV Trained Personnel: 47 Facilities available for foaming of Runways: NIL									
10	Postal Address: Civil Aerodrome, Ahmadabad. PIN Code 380012.	25	Seasonal Availability: Aerodrome serviceable during all seasons. It should be used with caution during rainy season when the runways are likely to be water-logged or slippery.									
11	Telegraphic Addresses: (AFTN): VAAHYD (COMMERCIAL): Aerodrome, Ahmadabad.	26	Local Flying Restrictions: All aeroplanes maintain visual flight watch for flying club aero- planes and gliders. Due to unlighted obstructions in the circuit area, circuit below 150M (500 ft.) above ground level is to be undertaken with caution.									
12	Telephone Numbers: ATC 66041/2 & 66043 Aerodrome Officer (Office): 66041/1 & 66042/1, Aerodrome Officer (Res.) 66041/2 & 66042/2.	27	Pre-flight Altimeter Check Point(s) and Elevation: Not established.									
13	Overnight Accommodation: Limited accommoda- tion in city hotels.											
14	Restaurant Accommodation: Restaurants, Light refreshments; limited meals with prior arrange- ment with restaurant											
15	Medical Facilities: First aid treatment, rest room and ambulance. Hospital in the city - 2 NM.											
16	Transportation Available: Taxis in city											
17	Cargo Handling Facilities: Limited, manual.											
28	METEOROLOGICAL DATA											
Mean Daily Maximum and Minimum Temperatures (C)												
Temperature	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Maximum (a)	28.7	31.0	35.7	39.7	40.7	36.0	33.2	31.8	33.1	35.6	33.0	29.6
Minimum (b)	11.9	14.5	18.6	23.0	26.3	27.4	25.7	24.6	24.2	21.2	16.1	12.6
Monthly Mean Pressure in (MB) at approximately the times of maximum (a) and minimum (b) temperatures												
Maximum (a)	1006.7	1004.7	1002.1	999.1	995.4	999.6	992.1	994.1	997.5	1002.0	1005.4	1006.9
Minimum (b)	1009.8	1008.1	1005.9	1003.5	1000.5	996.6	995.2	997.2	1000.8	1005.3	1008.5	1010.0
Absolute Humidity (G/M ³) at approximately the times of maximum (a) and minimum (b) temperatures												
Maximum (a)	7.13	7.24	7.79	8.52	10.89	17.80	22.13	21.17	19.74	12.67	8.94	7.81
Minimum (b)	6.97	7.61	9.51	13.40	20.30	23.12	22.89	21.39	20.37	14.99	9.42	9.18

29

Slopes : Longitudinal Profiles of Runways



30

PHYSICAL CHARACTERISTICS

Runway		Dimensions (M)			Strip	Strength	Surface	
Designation	True Brg.	Runway	Stopway	Clearway		Runway	Runway	Stopway
a	b	c	d	e	f	g	h	i
05	046	2286M ± 46M		152M ± 305M	2408M ± 213.5M	LCN 40	Cement concrete	
23	226	7500 ft × 150 ft		500' ± 1030'	7900 ft × 700 ft			
14	136	1478M ± 46M		189M ± 305M	1600M × 152M		Cement concrete	
32	316	4850 ft ± 150 ft		620' ± 1000'	5240 ft × 500 ft			

Remarks : Rwy 14/32, used as taxi track.

31

Movement Areas

Aprons : 247M (68.5M (810 ft) ± 225 ft)

Surface : Cement concrete.

Taxiways : 1) Width 23M (75 ft.)

2) Width 15M (50 ft.)

Surface : Cement concrete.

Helicopter Alighting Areas : Not established

Remarks : 23M(75 ft.) wide middle portion of Runway 32/14 11.5M (37.5 ft.) (on both sides of Central Line from R/W 05 edge till first taxi track is having LCN 40. Remaining portion is having LCN 10. First taxi track 23M(75 ft.) wide and half of the apron in front of old Terminal Building is having LCN 40. Remaining portion of Apron is having LCN 10.

VISUAL GROUND AIDS

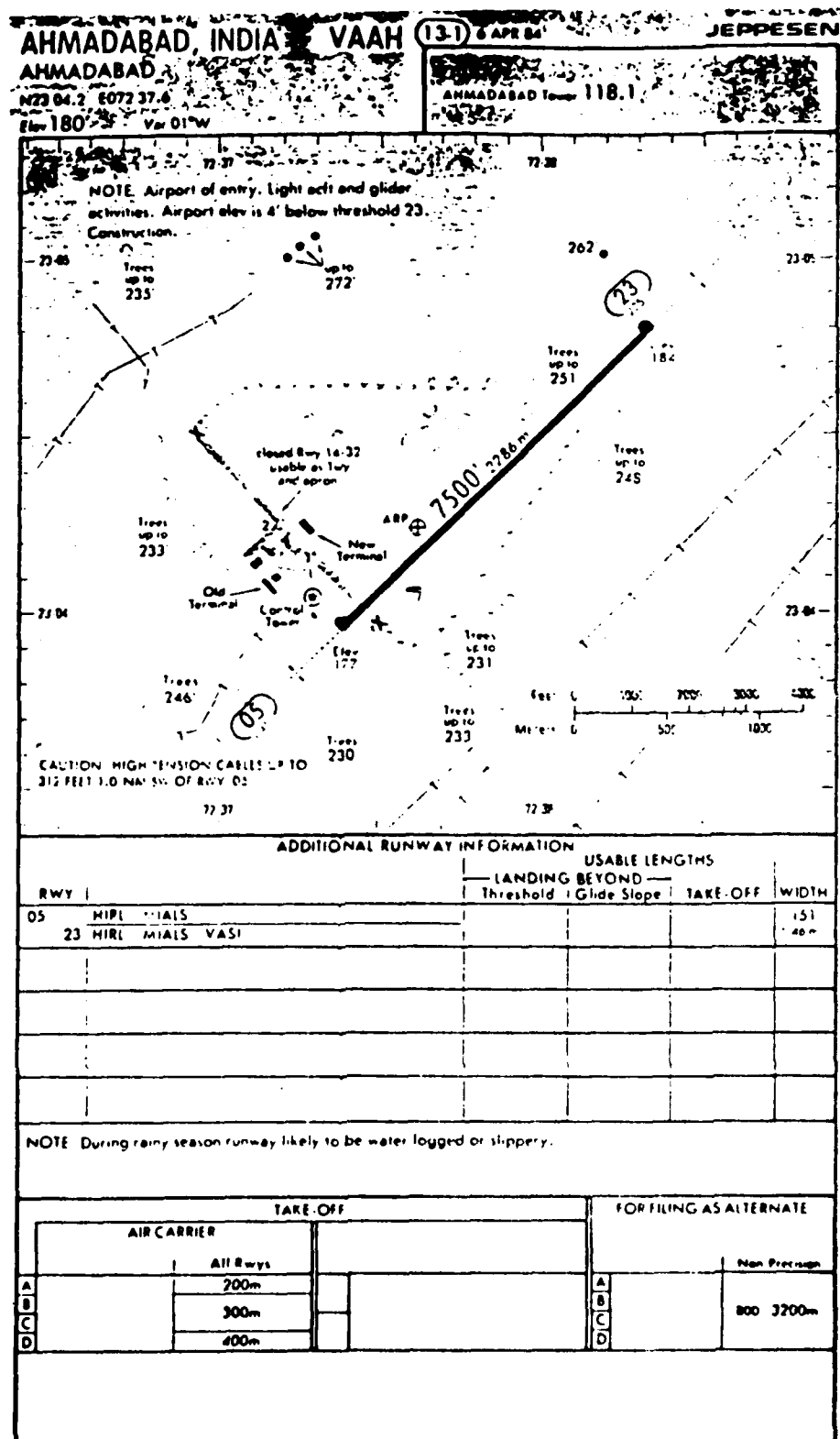
32 Taxiing Guidance Systems : Taxiing guidance given on R/T.

33 Visual Aids to Location : ABN—Flg W & G; Identification sign.

34 Indicators and Ground Signalling : Devices : LDI; WDI; Signal area—Not Lgtl.

35	Lighting Aids.																																											
Approach Lighting : Rwy 05 - Simple Approach Runway Lighting: RWY 05 } Edge, Threshold and End Omni directional, RWY 23 } of lights (High Intensity) variable. Rwy 23 - -do- Other Lighting : Taxiway - Provided Apron flood lights - Provided. VASIS : 2 Bar VASI for R/W 23 Glide angle 2.96°.																																												
36	Emergency Lighting and Secondary Power Supply: Paraffin flares available. Secondary power supply available. Maximum switch over time / minute .					37	Obstruction Marking and Lighting: Some of the operationally significant obstructions are not lighted and marked.																																					
38	Marking Aids : Threshold, designation numbers, centre line - 05/23 Rwy. Taxi holding position, centre line - all taxiways.																																											
39	Obstructions in Approach and Take-off Areas																																											
<table border="1"> <thead> <tr> <th rowspan="2">Rwy</th><th rowspan="2">Type</th><th rowspan="2">Elev (M)</th><th colspan="2">From Rwy Threshold</th><th rowspan="2">Rwy</th><th rowspan="2">Type</th><th rowspan="2">Elev (M)</th><th colspan="2">From Rwy Threshold</th></tr> <tr> <th>Dist (M)</th><th>Mag</th><th>Dist (M)</th><th>Mag</th></tr> <tr> <th>a</th><th>b</th><th>c</th><th>d</th><th>e</th><th>a</th><th>b</th><th>c</th><th>d</th><th>e</th></tr> </thead> <tbody> <tr> <td colspan="10" style="text-align: center;">This information is depicted in Aerodrome obstruction chart ICAO (Type A)</td></tr> </tbody> </table>											Rwy	Type	Elev (M)	From Rwy Threshold		Rwy	Type	Elev (M)	From Rwy Threshold		Dist (M)	Mag	Dist (M)	Mag	a	b	c	d	e	a	b	c	d	e	This information is depicted in Aerodrome obstruction chart ICAO (Type A)									
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RWY	TORA	ASDA	TODA	LDA																																								
M	M	M	M	M																																								
05	2286	2286	2437	2286M																																								
23	2286	2286	2469	2286M																																								
14	Nil	Nil	Nil	Nil																																								
32	Nil	Nil	Nil	Nil																																								
<p style="text-align: center;"><u>KEY:</u></p> <p style="text-align: center;">TORA – Take Off Runway Available</p> <p style="text-align: center;">ASDA – All Stop Distance Available</p> <p style="text-align: center;">TODA – Take Off Distance Available</p> <p style="text-align: center;">LDA – Landing Distance Available</p>																																												

Appendix C: Civilian Airports



2	Ref. Point: Lat. 25°27'03"N Long. 82°51'38"E Site : 491 m Bearing 071° Geo from Control Tower.	1	City/Aerodrome: VARANASI/Varanasi
3	Distance and Direction from City : 18 km. Bearing 320° Geo from Varanasi Railway Stn.	17	Cargo Handling Facilities: Limited. Manual.
4	Elevation : 80 m.	18	Fuel Grades : TF K. 50 Limited Stocks.
5	Aerodrome Reference Temperature: 41.5°C (May)	19	Oil Grades : 100, 120 and Water Methanol 45 : 55 Limited Stocks.
6	Magnetic Variation: 0°22' W (1975)	20	Oxygen and Related Servicing : Nil
7	Transition Altitude : 1200 m. (4000 ft.)	21	Refuelling Facilities and Limitation : (a) HO (b) Other times not available for Non-Schedule. (c) Bowsers
8	Operational Hours : TOWER : HO TMA : H+24	22	Hangar Space Available for Visiting ACFT: NIL
9	Aerodrome Operator or Administrative Authority : Director General of Civil Aviation, New Delhi. Pin Code: 110 022	23	Repair Facilities Normally Available : NIL
10	Postal Address: Civil Aerodrome, Varanasi, Pin Code: 221006	24	Fire Protection: Required: Category V Available: Category V Trained Personnel: 35 Facilities available for foaming of Runways: NIL
11	Telegraphic Addresses : (AFTN) : VIBNYD (Commercial) : Aerodrome, Varanasi.	25	Seasonal Availability : Aerodrome generally remains serviceable during all seasons.
12	Telephone Numbers : ATC: 64186 Aerodrome Officer (Res) - (Office) 62543	26	Local Flying Restrictions : NIL
13	Overnight Accommodation : Nil at Aerodrome. Accommodation available in City Hotels.	27	Pre-Flight Altimeter Check Location (a) and Elevations : Not established.
14	Restaurant Accommodation: Restaurant avail- able. Light refreshments. Limited meals with prior arrangements with the Restaurant.		
15	Medical Facilities: First aid treatment and Ambulance. Hospitals in City - 22 km.		
16	Transportation available : Nil at Aerodrome. Taxis available in City.		

METEOROLOGICAL DATA

Mean Daily Maximum and Minimum Temperatures (C)

Temperature	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Maximum (a)	23.1	27.2	33.2	38.8	41.5	38.9	33.0	32.3	32.4	32.2	28.6	24.7
Minimum (b)	9.2	11.5	16.9	22.2	26.9	28.2	26.4	26.1	25.4	21.1	12.9	9.5

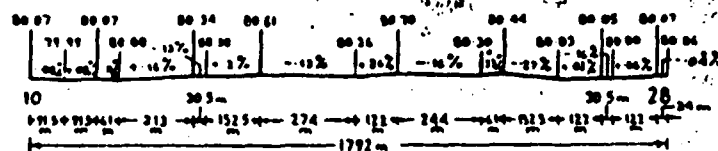
Monthly Mean Pressure in (MB) at approximately the times of maximum (a) and minimum (b) temperatures

Maximum (a)	1005.1	1002.1	998.3	994.1	989.1	985.9	987.3	988.4	992.2	998.3	1003.3	1005.6
Minimum (b)	1006.4	1005.2	1002.3	998.4	993.3	989.7	990.2	991.6	995.6	1001.7	1006.5	1008.7

Absolute Humidity (G/M³) at approximately the times of maximum (a) and minimum (b) temperatures

Maximum (a)	9.91	9.41	8.42	7.50	11.07	19.14	23.38	24.10	22.54	16.76	10.49	10.09
Minimum (b)	9.29	9.47	9.74	9.66	13.76	20.94	23.44	23.77	22.93	17.59	10.89	9.33

SLOPES: LONGITUDINAL PROFILES OF RUNWAYS STOPWAYS AND CLEARWAYS



PHYSICAL CHARACTERISTICS

Runway		Dimensions (M)				Strength	Surface	
Designation	True BRG.	Runway	Stop-way	Clearway	Strip	Runway	Runway	Stop-way
a	b	c	d	e	f	g	h	i
09	093°	1792m x 46m.	-	198m x 152m.	1914m x 152m.	LCN-30	Bituminous over 1ays over Concrete Pavements	-
27	273°		-	183m x 152m.				-

- 1) Threshold of Rwy 09 temporarily displaced by 324m due tree in approach funnel, height 101m at a distance of 728m from Rwy 09 Basic Strip.
- 2) Threshold of Rwy 27 temporarily displaced by 376m due trees in approach funnel, height 1091m at a distance of 1091m from Rwy 27 Basic Strip.

MOVEMENT AREAS

Taxiways: Width 23m.

Surface: Bituminous over Concrete Pavement.

Helicopter Alighting Areas : Not established.

VISUAL GROUND AIDS										
32	Taxying Guidance Systems: Taxying guidance given on R/T.									
33	Visual Aids to Location: ABN FLC W & C IDENTIFICATION SIGN.									
34	Indications and Ground Signalling Devices: LDI) WDI) Unlighted. Signal Area)									
35	Lighting Aids									
Approach Lighting: NIL					Runway Lighting: Rwy 09/27 Edge, Threshold and End Lights. Taxiway Lights: Available) Temporary dis- Other Lights: Apron Flood) mantled due to Lights) extension of Taxi- Track and apron.					
36	Emergency Lighting and Secondary Power Supply: Paraffin flares. Secondary Power Supply available maximum switch over time 1½ minutes.				37	Obstruction Marking and Lighting: All operationally significant obstructions are lighted.				
38	Marking Aids:									
39	OBSTRUCTIONS IN APPROACH AND TAKE-OFF AREAS									
	RWY	TYPE	ELEV (M)	FROM RWY THRESHOLD		RWY	TYPE	ELEV (M)	FROM RWY THRESHOLD	
	a	b	c	DIST (M)	MAG	a	b	c	DIST (M)	MAG
	09	Tree	94.4	694.9	273° 30'	27	Tree	90.5	539.5	091° 0'
	39	"	96.3	713.2	274° 30'	27	"	94.5	612.5	091° 30'
	09	"	95.4	643.1	264° 30'					
	09	"	101.0	792.4	280° 0'	27	"	93.5	686.0	067° 30'
	09	"	96.3	807.7	285° 0'	27	"	109.5	1158.00	099° 0'
REMARKS:										
Declared Distances:			RWY	TORA M	ASDA M	TODA M	LDA M	40		
			09	1792	1792	1990	1468	NIL		
			27	1792	1792	1975	1416			
41	DISABLED AIRCRAFT REMOVAL: CAPACITY: NIL									

**Civil Airlines/Air Services in Bangladesh
India and Pakistan**

Prepared for
**Defense Intelligence Agency
Washington, D.C.**

Contract No.: MDA 908-84-C-0834

March 1985

DISCLAIMER STATEMENT

"The views, opinions, and findings contained in this report are those of the author(s) and should not be construed as an official Department of Defense position, policy, or decision, unless so designated by other official documentation."

**CIVIL AIRLINES/AIR SERVICES
IN BANGLADESH, INDIA AND PAKISTAN**

Volume IV - Pakistan

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1.0 SUMMARY

The primary objectives of this section of the study are to inventory the civilian aircraft and air services of Pakistan, evaluate the role of civil airlines during wars and national emergencies, and assess the potential use of civil airlines in supplementing the military's troop and equipment carrying capabilities if called upon during future war emergencies.

The project team collected data on the capacity and capabilities of Pakistan International Airlines (PIA), Pakistan's only civil airline. The team examined PIA's role in past national emergencies, reviewed their operating and legal framework, evaluated their potential for use in future emergencies, and collected data on the operational and support staff. Only publicly available data sources were used in the study. Sources included interviews, local newspaper coverage during times of major national emergencies, the project team's personal knowledge and understanding of operating efficiencies of Pakistan's civil airlines/air services, and a review of the geopolitical system that may influence the wartime utilization of civilian aircraft.

The research indicates that civilian aircraft have been used in the past for military purposes and have augmented the military's capabilities for troop and equipment movement. The PIA is a Government controlled operation under the Department of Defense. Therefore, the legal and political environment is not a constraint in the use of the civil airline during war emergencies. During postwar emergencies, the Pakistan Government has evaluated other options, such as road, railway and water transportation systems, and has used these extensively for military purposes before using civilian aircraft.

Most of the Pakistan civil airline flight equipment is comparatively new and the older aircraft are progressively being replaced with more efficient aircraft. Pakistan appears to have the necessary financial resources to meet these fleet expansions. Pakistan offers good maintenance and overhaul capabilities for the existing fleet and the number of incidents requiring the grounding of aircraft due to mechanical break down has been small. The major airports in Pakistan offer adequate communication, cargo handling, fuel availability, and maintenance facilities for general emergency needs whereas the minor airports have limited equipment and facilities, which restricts their use. Pakistan International Airlines train their own personnel, the training level appears to be adequate for commercial operations.

The Pakistan Air Force has only 15 transport aircraft and its capabilities appear to be somewhat limited for or speedy mass troop movement. Military aircraft can land on most of the civilian airports although availability of the fuel could be a problem. Communication capabilities at any airport could be upgraded by using mobile military communication capabilities.

Military considerations appear to influence some aircraft buying decisions in Pakistan. The Pakistan civil airlines appear to be capable of augmenting the military's ability to transport troop and light equipment during war emergencies.

2.0 INTRODUCTION

Woodward-Clyde Consultants, under contract No. MDA 908-84-C-0834 with the Defense Intelligence Agency (DIA), has performed a study entitled Civil Airlines/Air Services in Bangladesh, India, and Pakistan. The purpose of this study was to (1) examine and discuss the capability and capacity of the civil airlines and civil air services of the three countries, (2) evaluate their potential to support their states' military forces in the event of conflicts or other national or defense emergencies and (3) research subject states' past employment of their civil airlines/air services during such occurrences. The objectives of the study as outlined in the contract and as discussed with the DIA in a meeting on March 29, 1984 at Washington, D.C. include:

- Inventory of the civil airlines' flight equipment, and their capacity for normal operations
- Description of civilian airports, personnel, communication systems, and maintenance facilities
- Description of the organizational, legal and operational framework of the civil airline and its financial resources
- Research of the previous use of the civil airline and other transportation systems during national emergencies
- Evaluation of civil airlines and military interface during normal and emergency conditions
- Review of the capabilities of military aircraft and military airports

- Evaluation of the capabilities and the potential use of the civil airline to serve the needs of the military if called upon during national emergencies.

The report is divided into four volumes. Volume I is a summary report that provides an overview of the capacity and capabilities of each country's civil and military airlines, including flight equipment, airport data, personnel information, level of training, maintenance capabilities, future planned acquisitions, and a brief description of each country's military aircraft and military airports. Based on publicly available data, the potential use of the civil airlines is evaluated and their operating environments are reviewed to determine the civil airlines' capabilities to serve the needs of the military during emergencies. Bangladesh, India and Pakistan are discussed individually and in more detail in volumes II, III, and IV, respectively. These volumes present available factual data including an inventory of aircraft, list of airports, staff categories and their training requirements, communication systems, maintenance facilities and a brief assessment of the potential use of the civil airlines during national emergencies. For the purpose of this study, civil airlines are defined as those publicly owned and operated country airlines which provide non-military passenger and cargo transportation. Figure 1 presents the location of Bangladesh, India and Pakistan.

3.0 RESEARCH METHODOLOGY

Woodward-Clyde Consultants' research methodology is presented in Figure 2. The research methodology was divided into the following five tasks:

- i) Identify Study Parameters
- ii) Define Data Needs
- iii) Collect Data
- iv) Analyze Capabilities
- v) Evaluate Potential for Future Use.

i) Identify Study Parameters

To the identify of the study parameters, Woodward- Clyde Consultants used the scope of work as defined in the solicitation the contract as a base document. An understanding of this task was supplemented by a discussion of the objectives and scope of work with DIA. The understanding was enhanced by the project team's knowledge of the utilization of civil aviation in Pakistan during normal and emergency conditions.

ii) Define Data Needs

After identifying the study parameters, Woodward-Clyde Consultants defined the data needs to satisfy the objectives of the study using DIA's letter U-25-029 dated April 23, 1984 as a guideline. The data needs identified in this task included (a) inventory-type information about aircraft, airports, personnel, communication systems, and maintenance facilities and (b) historical data on the past use of Pakistan civil airlines during national emergencies. These data were used in the

evaluating and assessing civil aviation's ability to support Pakistan's military forces during national emergencies. Adequacy, completeness, and accuracy of the data were considered of prime importance for the purpose of this study.

iii) Collect Data

Woodward-Clyde Consultants identified a number of primary sources for data collection. These sources included a review of civil aviation publications and local Pakistan newspapers, particularly around the dates of national emergencies; a study of civil aviation data; and personal interviews with people knowledgeable in Pakistan civil aviation matters. Table 1 presents a list of libraries used by members of the project team for data collection. Table 2 is a list of local newspapers that were researched for any news coverage of the role of civil aviation during national emergencies. During the newspaper studies, special emphasis was given around the dates of the border conflicts and wars between India and Pakistan in 1947-1948, 1965, and 1971, and around major natural disasters. The collected data was supplemented by personal interviews by members of the project team with people knowledgeable in Pakistan civil aviation operation and practices. These interviews were used to fill data gaps in the publicly available information, update data, and develop a realistic model to assess airlines capabilities to supplement military strength during war emergencies.

iv) Analyze Capabilities

An analysis of the capabilities of Pakistan civil aviation to help Pakistan's military forces, as presented in this report,

was based on (a) publicly available data as collected in Task (iii), (b) the knowledge and expertise of the project team and its consultants and their overall understanding of the Pakistan civil aviation and military operations, and (c) interviews with people who are knowledgeable and experienced in Pakistan civil aviation and the role it has played during past national emergencies.

The reviews of local newspapers revealed little directly applicable information on the use of civil aviation for military purposes during Pakistan wars with India. During the wars of 1965 and 1971, civil aviation operations (including foreign airline flights to Pakistan) were more or less completely disrupted to avoid civil aviation aircraft being caught in aerial warfare, fuel shortage and the non-operation of navigational aids at the airports. During natural emergencies, Pakistan Air Force aircraft and helicopters were often used to drop relief goods and medical supplies in the affected areas. Although it is reported that mass troop movements were accomplished by the use of Pakistan International Airlines aircrafts, the newspapers have generally not covered the use of civilian aircrafts for troop, equipment, and artillery movements. In Pakistan, such movements are considered too sensitive from a military strategy point of view to be mentioned in public newspapers.

v) Evaluate Potential for Future Use

The data analysis in Task (iv) formed the basis for evaluating the future use of airlines for military purposes. Several scenarios and purposes were evaluated. A description of the assessment and potential use of airlines for military purposes has been presented in Section 7 and 8 of this report.

4.0 LIMITATIONS OF THE STUDY

The contract scope of work required the use of open source material only with no field research in Pakistan. The project team found limited publicly available information in the United States in the areas of personnel training, communication systems, maintenance facilities, the future outlook of Pakistan civil aviation, and civil and military interface during national emergencies. Although Pakistan is a member of the International Civil Aviation Organization and some information on its civil aviation resources is publicly available, major data gaps exist for the specific purpose of the study. For instance, it is rare that evaluation-type information on Pakistan civil aviation is published in journals. Moreover, specific questions from outsiders about the capabilities and capacities of civil aviation generally arouse suspicion in the minds of Pakistan officials. The project team was able to fill data gaps by interviewing a number of Pakistanis who worked with Pakistan civil aviation and are now living in the USA. Information presented in this report is correct to the extent that public sources were available to serve the general purpose of the study. A full capability assessment may require additional information in the future.

5.0 CIVIL AIRLINES/AIR SERVICES IN PAKISTAN

5.1 General Overview

5.1.1 Origin and History

Although Pakistan came into being in August 1947, the origin and history of Pakistan International Airlines (PIA) goes back one year earlier to October 1946, when Mohammad Ali Jinnah, the founder of Pakistan, formed the Muslim-owned Orient Airways Limited in Calcutta. The airline started passenger service with four converted DC-3s bought from TEMCO of Texas, U.S.A. and operated mainly between Calcutta and Rangoon during early 1947. The formation of Pakistan as an independent state and the 1000 miles distance between the western (now Pakistan) and the eastern (now Bangladesh) wings of the country brought into focus the importance of communication links and air transportation for Pakistan. In 1947 Pakistan had very few trained personnel and limited facilities for maintenance, support, and training for commercial air fleets; the only airport was at Kanachi, which served mainly foreign airlines. In September 1947, the Government of Pakistan chartered Orient Airways for the operation of air routes between and within East and West Pakistan. According to the official policy announced in December, 1947, civil aviation was considered a private enterprise subject to public regulation through a Government licensing system. The Government established an Air Licensing Board in early 1948 which authorized flight operation to the Orient Airways and the Pak Air Limited, another airline formed with support from the U.S. firm Trans-Ocean Airlines. Pak Air folded in 1950 because of two serious accidents. Meanwhile, the Orient Airways progressed and expanded its fleet by acquiring three Convair CV-240 aircraft and operated them on Karachi-Delhi-Calcutta-Dacca routes. In order to meet

expansion needs, Orient Airways incurred major expenditures in training and facilities which placed a heavy financial burden on the airline. In the interim, the Government of Pakistan granted a permit to another local operator, Crescent Airways, to operate within the west wing and British Airways was allowed to fly between Karachi and Dacca. These actions divided the passenger and cargo traffic between the Orient Airways and the other two air carriers and drastically reduced Orient's revenues and operations.

By 1952, the need for an organized, financially strong and government backed national airline was felt very strongly. As a result, Pakistan International Airline (PIA) was established as a department under the Civil Aviation Directorate of the Pakistan Ministry of Defense. Pakistan bought three Lockheed L-1049C Super Constellation aircraft capable of flying non-stop between the eastern and the western wings of the country. In October 1953, an interim joint operating agreement was reached between PIA and Orient Airways; the Government took over the Orient Airways and merged its operation with PIA. The merger between the two airlines was formalized in March, 1955 by the promulgation of the Pakistan International Airlines Corporation Ordinance, 1955; Pakistan International Airlines Corporation was established as an autonomous public corporation which took over the operations of Orient Airways. Thus the Ministry of Defense was engaged in doing business under the name of Pakistan International Airlines. The Government of Pakistan had a majority of holding and control in the PIA Corporation; the minority interest was held by several individual stockholders. The newly formed PIA Corporation's fleet in 1955 consisted of three L-1049C Super Constellations, two Convair CV-240, and eleven DC-3s.

Although the Government of Pakistan formed the infrastructure of a national airline in the form of PIA Corporation, it lacked technical and executive staff, ground schools, communication networks, ground operations, and other essential support facilities. The task of developing PIA into a self sustaining air carrier performed by Pan American World Airways under the sponsorship of the Government of Pakistan and the U.S. Agency for International Development (USAID). This program of technical assistance and training for PIA personnel by Pan Am lasted thru 1962. During this time, Pan Am advisors provided close to 166 man years of work in Pakistan and improved all phases of air and ground operations. Under the USAID program, the Government of the United States provided equipment for the modernization of the airline. Under the sponsorship of the Government of Pakistan, PIA flourished, improved revenues, and in 1960 registered a profit for the first time. Meanwhile PIA increased its fleet by adding two Super Constellations (L-1049H series) in 1958, five Vickers Viscounts (815 series) in 1959, a leased Boeing 707-34 Intercontinental in 1960 (which operated between Karachi and London), and three Boeing 720-Bs in 1962. PIA also acquired three Sikorsky S-61N helicopters that it operated commercially for passenger transport in East Pakistan (now Bangladesh), but this service was stopped in 1966 after the crash and total loss of two helicopters. During the years 1964 thru 1967, PIA introduced flights to the Peoples Republic of China and to the USSR. In addition to these countries, PIA operates flights to the USA, Europe, Africa, and the Middle and Far Eastern countries.

5.1.2 Operating Environment

Pakistan is bounded on the south by the Arabian Sea, on the west, northwest, and north by Iran and Afghanistan, on the northeast by the Peoples Republic of China, and on the east by

India. About one-third of the Pakistan-Indian border lies in the disputed territory of Jammu and Kashmir State. Geographically the country is composed of highlands located mainly in the north, Baluchistan Plateau and the frontier mountains on the western flank, and the Indus River plains of Punjab and Sind. The climate of Pakistan is warm and arid, with an average annual precipitation of less than ten inches. Timber and natural vegetation is sparse. More than seventy percent of the population is rural. The total population is more than ninety million; its annual growth rate is about 3.5 percent.

The northern highlands is a region of rugged mountains including the Himalayas which merge at the northwest corner into the Karakoram and Pamir mountain ranges of Pakistan. In this region, all elevations are above 8,000 feet and more than one-half of the region is above 15,000 feet with fifty peaks above 22,000 feet. The tribal political agencies Baltistan and Gilgit are located in this region. The Khayber Pass lies in the northwestern part of the country near Peshawar; in this area the elevations range between 9,000 to 15,000 feet.

The Baluchistan Plateau ranges in elevation between 3,000 to 4,000 feet; its principal city Quetta is 5,500 feet above sea level. It is the focal point of the railway system in the region. The Indus Plain varies in elevation between 500 to 1,000 feet in Punjab and close to sea level in Sind. Several major desert areas lie in this region.

Pakistan has four climatic seasons. These are: (1) dry and cool winter from December through February; (2) dry and hot summer from March through May; (3) rain season from June through September; and (4) retreating rain and the start of winter in October and November.

5.1.3 Legal Framework

The basis of civil aviation laws in Pakistan is the Indian Aircraft Act of 1934. After the formation of Pakistan, these laws continued to apply, but Parliament was given exclusive power to make laws with respect to airways, aerodromes, aircraft, air navigation, and all matters pertaining to the safety of aviation. Later, the laws governing civil aviation were formalized in Ordinance No. XXXII of 1960 by the President of Pakistan. Section 6.1 of this ordinance and its Subsection a, b, c, and d specifically provide provision during war emergencies. These include:

- (1) In the event of war or other emergency, or in the interest of public safety or tranquility, if the Central Government is of opinion that the issue of all or any of the following orders is expedient, it may, by notification in the official Gazette,
 - (a) cancel or suspend, either absolutely or subject to such conditions as it may think fit to specify in the order, all or any of the licenses or certificates issued under this Ordinance or the rules
 - (b) prohibit, either absolutely or subject to such conditions as it may think fit to specify in the order, or regulate in such manner as may be specified in the order, the flight of all or any aircraft or class of aircraft over the whole or any part of Pakistan
 - (c) prohibit, either absolutely or conditionally, or regulate the construction, maintenance or use of any aerodrome or airport, aircraft factory, flying-school or club, or place where aircraft are manufactured, repaired or kept, or any class or description thereof;

- (d) direct that any aircraft or class of aircraft or any aerodrome or airport, aircraft factory, flying-school or club, or place where aircraft are manufactured, repaired or kept, together with any machinery, plant, material or things used for the operations, manufacture, repair or maintenance of aircraft shall be delivered forthwith or within a specified time, for being placed at the disposal of the Central Government, to such authority and in such manner as it may specify in the order.

The ordinance further says:

The central government may authorize such steps to be taken to secure compliance with any order made under subsection (1) as appear to it to be necessary

and

whoever knowingly disobeys, fails to comply with, or does any act in contradiction of an order made under sub-section (1) shall be punishable with imprisonment for a term which may extend to three years, or with fine which may extend to five thousand rupees, or with both,...

Although the Pakistan International Airlines Corporation is an autonomous corporation which, in discharging its functions, is supposed to have a careful regard to business principles, it is fully bound by the directives of the Government on matters of policy.

The administration of the corporation is performed by a Board of Directors appointed by the Government. The Government owns a majority of shares in the corporation. Therefore, in an emergency situation there is no legal problem in diverting the

resources of the Pakistan International Airlines for the use of the military at the discretion of the Government of Pakistan.

5.1.4 Financial Position

Pakistan International Airline's financial statement for 1983 and 10-year Operating Statistics are presented in Appendix A. In 1983, 85 percent of PIA revenues were generated from passenger ticket sales, 10 percent from freight and 5 percent from engineering services and training that PIA provided to various organizations/airlines. On the direct expenditure side, excluding depreciation and interest, PIA spent 42 percent on fuel, 15 percent on salaries, 8 percent on maintenance (which includes 4 percent for spare parts) and 35 percent on other expenses. PIA made a profit of U.S. \$ 55.3 million in 1983; it appears to be a financially sound airline. PIA has made profits from its operations in each of the last ten years. The sound financial position will help PIA to acquire new and more efficient aircraft in the future which will increase its utility and reliability during emergencies for military use.

5.1.5 Key Personnel

5.1.5.1 Directors and Management Personnel

Table 3 presents the names and positions of the corporation's Board of Directors and the operating management of PIA. There is a great number of military personnel in the PIA management compared to India and Bangladesh. On the Board of Directors, four out of twelve are active or retired Army or Air Force personnel, including Major General M. Rahim Khan, Chairman and Director; Air Chief Marshall M. Anwar Shamim; Air Vice Marshall Khurshid Anwar Mirza; and Air Vice Marshall Wiqar Azim. The remaining directors are either bankers or top planning officers in the Pakistan Government. The Managing Director of PIA is

Air Vice Marshall Wiqar Azim (also a member of the Board of Directors); the Director of Administration is Commodore Mumtaz Ali; and the Director of Sports is Brigadier Atif. All of these are retired military personnel that have direct links with the Pakistan military. This makes the use of the civil airline for military purposes operationally smooth.

5.1.5.2 Selected Key Personnel Profile

A brief profile of selected key personnel of PIA is presented in Table 4.

5.2 Flight Equipment and Facilities

5.2.1 Aircraft

There are seventy civil aircraft in Pakistan. Thirty of these aircraft are operated by Pakistan International Airlines; twenty one are large commercial jets and nine are large passenger turboprops. The remaining forty aircraft are operated by the Pakistan Government, flying clubs, or private individuals and are primarily light single-engine aircraft.

5.2.1.1 Pakistan International Airlines Fleet

The PIA fleet consists of six Airbuses, seven Boeing 707s, four Boeing 747s, nine Fokker F27s, and four DC-10s. Table 5 summarizes the PIA fleet and lists aircraft serial numbers, dates of manufacture, and dates of delivery to the PIA. Figures 3 through 7 present the sketches and general aircraft data.

5.2.1.2 Government Fleet

The Government of Pakistan owns and operates a number of aircraft. Their fleet consists of Beavers, Cessnas, and Fletcher aircraft. Table 6 presents the location and the number of these aircraft; Tables 8 and 9 present general aircraft data.

5.2.1.3 Flying Clubs Fleet

Table 7 presents the type, number, and location of aircraft owned and operated by various flying clubs in Pakistan. General aircraft data is presented on Table 10.

5.2.2 Condition and Age of Fleet

The delivery date of various aircraft to PIA is presented on Table 5. The twelve aircraft, the A300, B747-200B, and DC-10-30(s) are modern wide-body aircraft. The B707-300 aircraft are older, but according to a PIA source, are well maintained. The nine Fokkers are older aircraft as well. These carry about forty passengers. They are operated for short flights within the country. Their maintenance record is average.

The dates of manufacture or dates of delivery of aircraft belonging to the Pakistan Government and to various flying clubs could not be ascertained from public sources. Generally, these aircraft are considered to be at least 10 years old and their maintenance record is reported to be below average.

5.2.3 Facilities

A list of avionic equipment aboard various aircraft is presented in Section 5.5.

5.3 Civilian Airports

The most current data sources report that there are 102 useable airfields in Pakistan, including military and civil aviation airports. In addition, there are many small airstrips of under 4,000 feet with soil or ground surface; some may be used in all weather and the remaining only in fair weather. About 66 airfields in Pakistan have permanent surfaces; 26 airfields offer a runway of 8000 feet or more. Only one airport, located at Quetta, has a 12,000 feet runway.

5.3.1 Location

The major Pakistan airports operated by PIA are presented on Figure 8 and Table 11, which also lists auxiliary airports. Appendix B presents some of the essential data on civilian airports.

5.3.2 Equipment and Facilities at Airports

Equipment and facilities differ markedly between the major and minor airports. Maximum passenger and automatic cargo handling facilities are available at Karachi Airport, which is also the headquarters of PIA. These include load devices, floating pallets, nets, structural igloos, main and lower deck containers, and improved passenger and computerized baggage handling capabilities. Equipment and facilities at smaller airports are limited and most functions are performed manually. A list of equipment available at various airports could not be found from public sources.

5.3.3 Major Airport - Karachi

The airport at Karachi is an example of a major airport in Pakistan. Table 12 presents essential airport data; the location is shown on Figure 8. It is the oldest airport in Pakistan. It is located 100 feet above sea level; average temperature at Karachi ranges between 72°F to 84°F. The airport has both concrete and bitumen runways which could land large aircraft. Various grades of aircraft fuel are available at Karachi. It is a base airport for a number of aircraft and handles a number of international flights.

5.3.4 Minor Airport - Gwadar

Gwadar is an example of a minor airport in Pakistan. Its runway length is 5,000 feet; therefore only small aircraft could land at Gwadar. Landing is restricted during daytime only. No fuel or maintenance facilities are available and in case of mechanical problems, mechanics and parts have to be flown in from Karachi. Table 13 presents essential airport data and the location of the airport is shown on Figure 8.

5.3.5 Military Airports

Although the Pakistan Air Force can use any airport, there are a number of airports that are designated as military airports. Figure 8 shows the location of military airports; essential airport data is presented in Appendix C.

5.3.6 Maintenance and Airport Construction

All airport maintenance and construction work in Pakistan is performed by the Airport Development Authority (ADA). The ADA is capable of handling all routine types of construction and

has also operated overseas for the last five years. For special projects or major airport expansions, the department of Civil Aviation retains the services of foreign consultants. Overall, the maintenance standards of ADA are considered fair to good but as a government department, it has some inefficiency and corruption.

5.4 Personnel

Table 14 presents the details of the operating personnel of PIA. Although a corporation, PIA runs under Government control, and compared to other Government departments, offers better fringe benefits, including free or heavily subsidized travel. This makes working for PIA very attractive for Pakistanis. About 70 percent of PIA's staff is in support and other categories with overlapping duties and confused functions. This produces bureaucracy at its worst and communications problems within the organization.

5.4.1 Staff Categories

Staff categories in PIA are similar to Indian Airlines. These consist of pilots, cabin attendants, other cockpit personnel, and maintenance and overhaul personnel. For several years after its inception, PIA employed foreign pilots and cockpit personnel, but since 1960, PIA operates with all Pakistani staff.

5.4.1.1 Pilots/Copilots

There are about 500 pilots and copilots in PIA. In the sixties and mid seventies, PIA had Air Force retired personnel as pilots, but this trend has gradually changed. Now a greater percentage of personnel are direct recruits who are given extensive training within Pakistan at PIA training facilities.

5.4.1.2 Other Cockpit Personnel

Other cockpit personnel include flight engineers, radio operators and navigators. PIA draws most of its cockpit personnel from polytechnic institutions and from the Air Force. These personnel are provided comprehensive training and pass licensing examinations before assuming operational duties on the aircraft.

5.4.1.3 Maintenance and Overhaul Personnel

The maintenance and overhaul personnel are now hired directly by PIA, although a small percentage are ex-Air Force employees. Generally the directly hired personnel have basic theoretical and some practical knowledge in mechanical engineering and they are given specialized training with PIA in all phases of aircraft maintenance.

5.4.2 Training

Two training centers are located at Hyderabad and Karachi. The Civil Aviation Training Institute at Hyderabad offers ATC courses in Communications and Navigation. This facility was jointly funded by the United National Development Program (\$1.8 million) and the United States (\$75,000). PIA's training center at Karachi features a full range of cockpit training including flight simulators and cockpit procedures training. This training center has earned much needed foreign exchange by providing training to foreign nationals. Since 1956, some 500 pilots and flight engineers, plus approximately 1,400 maintenance personnel from foreign countries have been trained at Karachi. Airlines using these training facilities include ALIA, Air Lanka, Air Tanzania, Air Malta (the entire start-up operation was coordinated by PIA), Bangladesh Biman, Iraqi Airways, Iran Air, Libyan Arab Airlines, Egyptair, and others. Other local PIA training centers in Pakistan are at Lahore and Islamabad. Foreign training centers include Frankfurt, New York, Paris, London, Tokyo, Rome, Tripoli, Malta, and Aden.

The PIA has a fully operational Airbus cockpit system simulator at their Karachi Training Center. This simulator duplicates function and control characteristics and provides training on system dependencies, dynamics, and critical transients on the air craft to be flown. It enables the

performance of preflight check procedure, normal inflight procedure, and abnormal and emergency inflight procedure with selected failure modes.

Whenever PIA buys aircraft, the initial training is provided by the manufacturer of the aircraft. When this training was used for cross-training between civilian pilots and Air Force pilots, some internal conflicts were reported. When PIA introduced Airbuses into its fleet, the Air Force nominated certain number of pilots to be trained to fly the Airbus as part of the package deal. The PIA pilots objected to the Air Force decision to the point of a limited strike. It is reported that PIA management fired at least six pilots (who were later reinstated). It is also reported that cross training will be provided on PIA's proposed purchase of B-737s aircraft.

5.4.3 Affiliations

PIA had several local labor unions who were either left or right inclined. All these unions are now banned. Individuals have sympathies with various political parties but they are not allowed to support any of them openly. Under the essential services act, it is not possible for PIA employees to go on strike.

5.5 Communication Systems

5.5.1 Avionics and Inflight Communications

A list of equipment contained in various aircraft is presented on Table 15. Pakistan is a member of both the International Association of Travel Agents (IATA) and International Civil Aviation Organization (ICAO) and operates under their communication standards. As an operating practice, these standards are more strictly enforced on international flights rather than on local flights. It is not certain how well and in what condition the communication equipment operates on the local PIA fleet. Interviews with ex-PIA personnel revealed that essential and safety related equipment is generally kept operational on in-country PIA flights.

5.5.2 Ground Communication and Navigation Aids

The ground communication facilities and navigation aids available at various airports are presented on Tables 12 and 13 and in Appendix B and C. In addition to the airport facilities, most major cities have aeronautical beacons visible at all azimuths. For the purpose of air traffic control, the air space in Pakistan is included in the Karachi Flight Information Region (FIR). The Karachi Control Area is located within the Karachi FIR; its lateral limit extends to 100 nautical miles radius around Karachi airport. All commercial airports in Pakistan have Aerodrome Control Zones which extend to a 25 nautical mile radius around major airports. All aircrafts that fly at night do so in accordance with the Instrument Flight Rules (IFR). There are several Air Traffic Advisory Routes in Pakistan which provide service to IFR flights over Pakistan airspace. These traffic advisory routes are not considered controlled airspace. Other communication

services include radio aids to navigation, time signals, and weather broadcasts. On request and with permission from the Pakistan Air Force, civilian aircraft could use the communication and other facilities at the military airports. The meteorological facilities for civil aviation are provided in collaboration with the Director of Meteorological Service which operates under the Ministry of Defense. The main Meteorological Office at Karachi is responsible for providing information to civilian as well as to military aircraft.

5.6 Maintenance Facilities

5.6.1 Overview

Aviation maintenance facilities offered in Pakistan include manufacturing, maintenance and training. Although there are no major aeronautical manufacturing plants in Pakistan, smaller facilities exist. The Pakistan SAAB Safari TS-Mushak, a light trainer is assembled at the Aeronautical Complex at Kamra for the military. About 120 Mushaks have been produced through the end of 1983. A local Pakistani work force also participates in the overhaul of SNECMA ATAR engines as well as the rebuilding of various airframes. The Kamra complex is equipped with electrical, hydraulic, instrument, radio and system shops. Another manufacturing complex is located at Risalpur, but no details are available on this operation. In addition to these military manufacturing complexes, PIA has three major maintenance facilities and offers FAA-approved engine maintenance to various aircraft in their fleet.

5.6.2 Capacity and Capability

The three PIA maintenance bases are located at Karachi, Lahore, and Rawalpindi. To a large extent, PIA offers self sufficiency in fleet servicing and operational facilities. These include support equipment, shops and hangars. PIA employs approximately 5,000 maintenance personnel, half of which are aeronautical engineers and technicians. Karachi is PIA's major maintenance base for overhauls and FAA approved engines. In order to provide maintenance to wide body aircraft, the PIA constructed a separate hangar exclusively for wide body aircraft in 1982. The details of the hangar are presented in Table 16. The other two maintenance facilities located at Lahore and Rawalpindi specialize in the repair, overhaul, and maintenance of Fokker aircraft.

The PIA capabilities at various maintenance facilities include complete servicing of areojet-engines and Boeing 707 and 720 aircraft; repair and overhaul of avionics equipment; repair of pneumatic components on Fokkers, Boeings and DC-10s; jetting of jet engines up to 10,000 pounds thrust, and repair of Boeings 747, DC-10 and Airbuses. PIA's equipment at their various maintenance facilities include hydraulic test stand, fuel accessories test stand, ground support and test equipment, gyroscope balancing equipment, vertical balancing machine, jet blade grader, pneumatic aircraft recovery system, hangar dock system, aerial work platform, and numerous other electrical, radio, navigation, cargo, and support-related system workshops. The PIA maintenance base at Karachi has computer facilities that have automated many maintenance tasks.

5.6.3 Maintenance Schedules

It is reported that PIA performs all maintenance checks on its various aircraft in strict compliance with the specifications. All such checks are performed in-house, which saves foreign exchange. Since 1983, PIA is performing at Karachi the D-check on DC-10's, which is considered a major maintenance task. In addition, PIA overhauls major components on all DC-10s, Airbuses, and Boeing 747s.

On aircraft which operate strictly on domestic flights, maintenance standards are reported to be average but all safety items are thoroughly checked and safety-related maintenance is properly performed. Therefore, PIA aircraft appear to be well maintained and would offer operationally reliable service if called upon to serve military needs during emergencies.

5.6.4 Availability of Spare Parts

The availability of spare parts does not seem to be a problem for PIA in servicing its aircraft. During 1982-83, PIA introduced major improvements in the Store Department, particularly in the area of inventory reduction, by selling surplus inventory. The entire inventory system was streamlined, and arrangements were made to introduce an on-line computer system for stockrooms. This system was expected to be fully operational in late 1984. From a military emergency point of view, the availability of spare parts does not seem to be a problem for PIA. In isolated cases some parts may be delayed accidentally in shipping or may be out of stock due to human error.

5.6.5 Maintenance Effectiveness

The maintenance effectiveness of the PIA is reflected in its fleet utilization and on time regularity. The following data, although old, shows that since 1965 fleet utilization is high and reports are that PIA is maintaining a high fleet utilization ratio on all its aircraft.

<u>Aircraft</u>	<u>Hours Per Day</u>				
	<u>1964-1965</u>	<u>1965-1966</u>	<u>1966-1967</u>	<u>1967-1968</u>	<u>1968-1969</u>
Boeing 707/720	10.3	11.3	9.87	9.37	9.15
Trident 1E (not in current use)		5.14	6.71	7.21	6.62
Fokker F-27	8.13	5.73	6.6	6.52	6.78

Similarly, PIA has been attaining an engineering on time system-wide regularity of between 80-90 percent during the past several years. From an overall maintenance effectiveness point of view, PIA offers a sustained good record.

5.7 Civil/Military Interface

5.7.1 Civil Military Interface-Normal Conditions

In Pakistan, the Minister of Defense is responsible for all matters related to civil aviation. These include the formulation of civil aviation policy and administration of the broad functions of civil aviation in the country. Under the Minister, the day to day administration of civil aviation is performed by the Director General, Civil Aviation Authority (CAA) who is a civil servant of the Government of Pakistan. The Director General, CAA is empowered:

- detail and inspect aircraft, cancel flights
- register and grant certificate of registration
- issue, renew, and suspend ground engineer's licenses
- grant licenses to pilots and members of the aircraft operating crew
- exempt military pilots from all or any part of the practical flying tests and technical examination required for granting a pilot's license,
- licence airports
- prescribe rules and regulations regarding the operation of scheduled or non-scheduled air transport services
- frame rules and regulations and prescribe conditions of operation necessary for the safety of the public

- direct a licensed operator to accord priority in booking of persons or freight on any scheduled service.

In addition to the Department of Defense, other Government departments concerned with civil aviation are the Ministry of Finance (revenue and customs), Ministry of Health (health measures at the airports), Ministry of Commerce (import and export of aircraft and other equipment), and Ministry of Foreign Affairs (international relations in the field of civil aviation). There is always consultation and close collaboration between the Pakistan Air Force and the Department of Civil Aviation in respect to air traffic control and flight information systems. Search and rescue operations in Pakistan are provided under a joint Air Force - civil organization under the direction of the Rescue Co-ordination Center at Karachi. The Pakistan Meteorological Department operates under the Defense Ministry and provides meteorological services to both civil aviation and the Pakistan Air Force.

Initial training of aeronautical staff selected for civilian airlines is provided at the Air Force School located at Korangi near Karachi. This staff later has to qualify in a licensing examination conducted by the Civil Aviation Authority and receive specialized training at the PIA training facility at Karachi. PIA, recently established a Precision Engineering Group that works in close liaison with the Air Force to upgrade aviation-related equipment and assist in the procurement and testing of such equipment. Military Air Traffic controllers are routinely cross trained and remain on duty at civilian airports located near military airports. No such cross training of civilian air traffic controllers is reported. At times Air Force aircraft are overhauled and maintained at the PIA maintenance base at Karachi.

Since its inception in 1955, PIA has usually been headed by active military personnel who, after completing their term of duty, go back to the military. The present chairman of PIA is a three star General who is also the Secretary General Defense. He provides a direct link between PIA and the Government and the Ministry of Defense. Therefore, there is interaction between the civil airline and the military both at the policy and the operation level, which will positively impact the airlines capability to help the military during emergencies.

5.7.2 Civil Military Interface-National Emergency

5.7.2.1 Organization

During wars, a state of emergency is declared in Pakistan and the military assumes control of all strategic services such as radio stations, railways, television stations, and airports. The commanding officer of a nearby Air Force base or the Army Commanding Officer of the city in which the airport is located assumes full control of the civilian airport and all major activities require his approval. The control towers are manned by civilian as well as military air traffic controllers. All navigational aids at the airports are made inoperable to prevent any raiding enemy aircraft from homing in on these facilities. Depending on the severity of the war, most civilian flights are cancelled and, because of blackouts, essential civil and civilian flights used for military purposes operate under visual flight rules (VFR). Ground communication between airports becomes very difficult because of heavy usage of these communication channels by the military. Fuel is rationed. Civil airline and air services personnel are considered essential employees and are required to be on-call if they are away from their place of duty.

It is reported that civil aircraft are generally used for military purposes during wars only if they are considered essential for the purpose of the mission and after evaluating the military's own resources and alternate means of transportation. These aircraft are flown by civilian pilots but they are only given very general advance information about their destination, contents of the cargo, or identity of the passengers. Although the aircraft rules of Pakistan prohibit the transport of explosives and arms in civilian aircraft, the rules can be overturned on the instruction of the Government. Therefore, organizationally, PIA is set up to transport men, light equipment, and supplies of the military during war emergencies.

5.7.2.2 Command, Control, and Communication

The three organizations connected with civil aviation in Pakistan, the Civil Aviation Authority (CAA), the PIA, and the Airport Development Authority (ADA), all operate under the Pakistan Ministry of Defense and therefore the flow of communication does not cut through various ministeries. PIA and CAA are usually headed by active military personnel, providing an easy interface between the military and the civil aviation. Civilian aircraft are generally called upon to assist the military by performing ordinary tasks, such as carrying men and material, that are comparable to their peacetime. The applicability of military rules on civil operations during emergencies does not seem to pose a problem to PIA employees in the performance of their functions. Also, during emergencies, the military interfaces at key operation areas with no disruption to the administrative structure of the civilian operations which remain intact.

The flow of command, control, and communication when the civil airline is required to help the military is similar to that in India. After the necessity and nature of the job is confirmed, the Military Commanding officer gets approval from the Department of Defense and instructs his counterpart in PIA and the CAA to perform certain functions. Airline supervisors instruct the concerned rank and file civilian staff, who carry out the desired tasks under the monitoring and overall control of the military. During emergencies, military needs take priority over other functions once the decision is made and approvals are obtained.

5.7.3 Past Use of Civilian Airline During Emergencies

It is reported that PIA aircraft have been deployed to perform various emergency related functions during several natural disasters and wars in the past. These have included:

- Airlift of essential food items to Gilgit and Skardu areas in the northwest parts of Pakistan
- Airlift of medical supplies and wounded during border conflicts with India
- Transport of arms and ammunitions from Iran and Turkey during the 1965 war with India
- Transport of relief goods including medical supplies, to various parts of Pakistan hit by heavy rains or earthquakes
- Mass movement of troops and supplies to East Pakistan (now Bangladesh) during 1971 to reinforce the Pakistan Military.

During all such deployments, no major conversions of the aircraft were reported and PIA crew flew these flights with support from the ground staff under the overall control of the military.

5.8 FUTURE OUTLOOK OF AIRLINES

The number of passengers carried and the number of passenger miles travelled by PIA are increasing about 7 percent per year. The ten-year Operating Statistics (Appendix A) show that PIA is on financial sound footing. In 1983, PIA's revenues increased about 18 percent compared to 1982. The PIA management realizes that fleet replacement and modernization of the existing ground facilities and equipment are essential for PIA to maintain its profitability and its position in the Asian aviation industry.

5.8.1 Aircraft

5.8.1.1 Future Aircraft Purchases

PIA has ordered six B737-300 aircraft; delivery is scheduled between May, 1984 and June, 1986. One will be delivered in May, 1985, four during June and July, 1986, and the last one in July, 1986. To finance this purchase, PIA was able to obtain a \$66.9 million loan from Import-Export Bank at 12 percent interest rate. The airline will make a cash-down payment of \$23.6 million and will raise the difference from private sources.

5.8.1.2 Planned Acquisition

Because they are a profitable and financially strong airline, PIA does not have a problem in obtaining financing to purchase aircraft. According to reports, two types of factors generally influence aircraft buying decisions: personal considerations and multiple use of aircraft including military applications. The personal considerations may include concealed fees and commissions paid by the aircraft manufacturer to Pakistani officials. One such example is the U.S. Justice Department's civil suit against McDonnell Douglas Corporation seeking more

than \$900,000 in damages for the U.S. Export-Import Bank. This suit stems from the alleged concealment of payments connected with the sale of four DC-10s to PIA between 1973 and 1977. The civil suit charged that McDonnell Douglas paid \$1,750,000 to four Pakistanis to complete the sale of the wide-bodied jets to PIA.

The multiple use of aircraft consideration includes its use during national emergencies, as reflected in PIA's decision to buy B737s. In 1977, the Pakistan Air Force established a Operations Planning Group to review better deployment of available resources during emergencies. Another purpose of the group was to improve coordination with the Navy and the Army. Selected key personnel from the Operations Planning Group were sent to the U.S.A for training. This awareness on the part of the military appears to have influenced the Boeing B737 purchase, since the B737 is a STOL (short take off landing) aircraft, it can easily be used for transporting men and light equipment, and can land on ordinary runways.

At the present time, PIA faces a lack of capacity in its cargo area. As an interim solution, PIA is planning to use two converted B-707s as freighter aircraft and also plans to supplement their capacity with a Boeing 747 combi configuration. It is anticipated that PIA will be needing a long-range, high density cargo aircraft in the next five years.

It is reported that the Government of Pakistan is planning to buy thirty to fifty new trainer aircraft. The main candidates are the Pilatus PC-7, the EMBRAER EMB-312 Tucano, the Aero-spatiale Epsilon and the Rhein Flugzeugbau Fantrainer. The Fantrainer made its first international flight to Pakistan in August 1984 for demonstration purposes. Pakistan is also reported to be interested in the Grumman E-2C Hawkeye surveillance aircraft.

5.8.2 Airports

A contract has been awarded to a U.S. Architect-Engineer Firm, Bechtel, to oversee a \$400 million program to expand and improve Pakistan's air transport infrastructure. This program is expected to be completed within the next five years. During this period major improvements are planned at Pakistan's three international airports located at Karachi, Islamabad and Lahore. Air traffic control, navigation aids and communications systems are also to be improved. A semicircular layout with 21 gates has been planned for Karachi Airport to handle about 10 million passengers annually. Although the final location of Islamabad Airport is still not decided, Netherlands Airport Consultants has been chosen to head the construction management at Islamabad. Aéroport de Paris, a French firm, will be the construction managers at Lahore Airport. Financing sources of the airport construction project are being explored at the present time.

In addition to the improvements at the three international airports, plans are underway for the construction of airports at Mangla, Okara, Mianwali, Sargodha, Bahawalpur, Jacobabad and Ormara. Also, Peshawar, Multan and Faisalabad airports would be expanded in the near future.

5.8.3 Facilities

PIA is planning several measures to upgrade passenger handling and communication facilities. These include setting up air conditioned lounges, round the clock baggage service, and computerized baggage tracing to reduce baggage losses. In the communication area inverted V type Dipole systems are being erected at domestic airports to facilitate communication. Direct dialing capabilities are being improved between the

engineering departments and distant airports. Computerized departure control are being introduced at Karachi Airport and plans are to computerize several booking offices in the near future. Computerized inventory control systems are being introduced to improve spare parts handling capabilities. Overall, several of these improved capabilities, particularly in the area of communication and spare parts handling, will make PIA a better equipped airline to perform during emergencies.

5.8.4 Second Airline in Pakistan

PIA operates in a monopolistic environment in Pakistan. On several occasions in the past there were indications that the Pakistan Government might allow a second airline to be formed, probably for domestic operations. Shaheen Foundation, which is an investment arm of the retired Pakistan Air Force employees, has shown an interest in taking a lead role if such an idea ever materializes. So far, it cannot be determined if the idea is feasible and if a second airline will be formed.

5.9 Military Aircraft

5.9.1 Pakistan Air Force. Pakistan Air Force (PAF) has about 220 combat aircraft and 17,600 personnel. The PAF's main offensive capability rests with its squadron stationed at Masroor Air Base (Karachi), which is equipped with Martin B-57B bombers. Based at Sargodha Air Base are four squadrons equipped with Dassault-Breguet Mirage aircraft that could perform interception, fighter, bomber, and tactical reconnaissance roles. In addition to these squadrons, the PAF has eight other squadrons that operate J-6 aircraft from bases at Sargodha, Masroor, Mianwali, Rafiqui and Peshawar. These squadrons perform fighter/ground attack roles. The aircraft in these squadrons have been modified to carry two AIM-9

sidewinder air-to-air missiles for improved interception capability. The striking capabilities of these squadrons may be supplemented by Chinese A-5 Phantom strike aircraft that the PAF has on order. The PAF's transport support aircraft are based at Chaklala (Rawalpindi) and Masroor (Karachi) Air Bases, which operate Lockheed Hercules (10C-130B, C-130E, L-100-20) aircraft. The PAF operates a number of fixed and rotary-wing aircraft in liaison and search-and-rescue roles.

The flying school at Risalpur provides initial flight training on PAC Mushaq and Cessna T-37B aircraft and further training on Lockheed T33A and Shenyang FT-6s aircraft based at Mianwali Air Base.

Table 17 provides a list of Pakistan Air Force aircraft.

5.9.2 Pakistan Navy. The Pakistan Navy has a small contingent of aircraft based at Karachi. These aircraft include three Breguet Atlantics, six Westland Sea King MK45 helicopters, and four Aerospatiale Alouette III helicopters. Table 18 includes a list of Pakistan Navy aircraft.

5.9.3 Pakistan Army. Table 18 presents a list of aircraft operated by the Pakistan Army. These aircraft include 50 Cessna O-1E Bird Dogs for observation and forward air control, 24 Mushaqs, and 24 Rheins FTB-337s. The army's combat and transport helicopters include 35 Aerospatiale SA 330 Pumas, 12 Mil Mi-8s, 20 Aerospatiale Alouette IIIs and one Bell 47G. It is also reported that the army has 12 Bell AH-1S Cobra antitank helicopters. The army does not have any transport aircraft.

6.0 OTHER TRANSPORT SYSTEMS

6.1 Pakistan Railways

The Pakistan Western Railways(PWR) offer one of the most common and comparatively cheap modes of mechanized transportation in Pakistan. The Pakistan Railways are owned and operated by the Government of Pakistan under the Ministry of Communications. They have extensive production facilities for manufacturing and assembly of locomotives, coaches, wagons, signalling and telecommunication equipment located at Lahore.

The PWR has a network of about 5,400 miles of track and about 840 stations spread over the four corners of the country except in the extreme northern and western parts of Pakistan, which are only accessible by air or by road. More than 85 percent of the track is broad gauge (width 5.5 feet). The railways annual passenger and freight volume is around 6 billion passenger-miles and 5 billion ton-miles, respectively. The Pakistan Railway System is presented on Figure 9.

During the two wars with India in 1965 and in 1971, railways were used for mass military movements with varying operating efficiencies. In 1965, the war fronts were along the cease-fire line in Kashmir, Rann of Kutch in the southeast, and the Lahore and Sialkot areas in Punjab. At the time of these conflicts, a majority of the railway system had only one track; therefore proper railway scheduling was a major problem.

It is reported that full train loads of men and equipment were delayed as long as two days in reaching their destinations because of the scheduling difficulties caused by one track. Immediately after 1965, the railway track system and scheduling capabilities were improved to a point that in the limited

confrontation in the west wing of Pakistan (now Pakistan) during the war with India in 1971, the railway system was extensively used for men and heavy equipment movement.

During the last ten years the railway system of Pakistan has lost revenues and importance to a rapidly developing motor transport system that offers the flexibility to readily respond to changes in population, production development, and manufacturing centers. The Government is aware of the rigidity of the railway system and has retained several consultants in the transportation areas who have advised various means to make the system more attractive to passengers. Their recommendations are in various stages of implementation but the exact status could not be verified from public sources. For long hauls and for the movement of heavy artillery and equipment, the railway system still offers an efficient means of military movement and is expected to be fully used in future war emergencies.

6.2 Road Transportation

Pakistan has a very elaborate road transport system that offers more flexibility to cope with the changing economy. Therefore road transport is very rapidly catching up with the railways as a means of moving goods and people. There are estimated to be over 50,000 miles of roads, of which about 40 to 50 percent are paved. Except for the major roads, the general condition of the roads is fair and the Government is spending considerable amounts of money to improve all roads, but visible progress is slow. Figure 10 presents the road system of Pakistan. According to one estimate there are about 50,000 trucks, 25,000 buses and close to 150,000 private cars using the road transport system of Pakistan.

During the 1965 and 1971 wars with India, under a Government directive, the private trucks and buses were required to make their services available to the military by registering with the local military office. Movements of cars was restricted to save fuel. Trucks were used more than buses and supplemented the military's men and equipment carrying capacity. The movement of all vehicular traffic in Pakistan during the wars remained very slow and sparse because of the fuel shortage, the need to keep the roads free for military movements, and black outs. Strategically, if a war breaks out in Baluchistan or in the extreme northern area of Pakistan, the road system will offer a viable means of transport to the military and it is anticipated that, as in previous wars, the men and equipment carrying capabilities will be augmented by the use of private trucks and buses. The only drawback could be that, as in India, truck and bus operators operate under a heavy profit motive and provide only barely essential maintenance which poses an operational problem but it may not be too serious because Pakistani drivers are generally good and innovative mechanics and could keep their machinery running under emergency conditions with minimum support from other sources.

7.0 ASSESSMENT FOR THE FUTURE USE OF CIVIL AIRLINES DURING EMERGENCIES

7.1 Emergency Scenarios

Pakistan, a predominantly Muslim country, shares its borders with politically unstable Iran and Afghanistan, friendly Peoples Republic of China (PRC) and India, with whom they have had several wars in the past. Figure 11 shows the political divisions of Pakistan. The country is politically divided into the four provinces of Sind, Batuchi'stan, Punjab and the North-West Frontier Province. Geographically, the country has northern highlands where the western extension of the mighty Himalayas meets the Hindu Kush and Korakaram mountain ranges, the sparsely populated Baluchistan Plateau and frontier mountains on the western flank of the country, and the Punjab and Sind plains of the Indus River. The general climate of Pakistan is arid, with an average precipitation of about ten inches. About 70 percent of the 90 million people in Pakistan live in rural communities. The natural resources of the country are meager. Pakistan, since its inception in 1947, has not been able to attain political and economic stability; in the past this has led the country to internal disturbances and external wars with India. Based on the 37 year history of the country, the civil aviation resources of the country have been used and are likely to be used again during the following emergency scenarios:

- Assistance during natural disasters
- Assistance in handling internal disturbances
- Assistance in national defense

The Pakistan military could call upon civil aviation resources to assist during natural disasters, major internal disturbances, wars, or military peace keeping missions. It is anticipated that civil aviation will be used for mass troop and light equipment movement, reconnaissance of disturbed areas within Pakistan, transportation of arms and ammunition, transfer of wounded from the battlefield, and carrying out military peace keeping missions within and outside the country. Table 19 shows a comparison of transport capabilities of the PAF aircraft, and the PIA fleet.

During war emergencies, civilian aircraft will increase the military's transport capabilities, as shown on Table 19. At the present time, the military has the following transport aircraft:

<u>Type</u>	<u>Description</u>
Hercules C-130 B/E	Medium combat transport, crew of five, up to 92 troops (64 paratroops) or 43,400 lbs of freight in the hold
Fokker F-27-200	Medium transport, crew of four, up to 48 troops or 24,000 lbs. in the cabin and hold
L-100-201	Medium combat transport, crew of five, up to 92 troops (64 paratroops) or 43,400 lbs of freight in the cabin and hold

It is obvious that the Pakistan Air Force has somewhat limited capabilities for a speedy mass troop movement. If such a need

arises in the future, civilian aircraft of PIA can supplement this capability. Before PIA is commandeered, it is expected that the military would first evaluate its own resources and other modes of transportation and use PIA aircrafts only if it offered a strategic or economic advantage. If it is established that civilian aircraft are needed for military purposes, the decision to use a particular type of civilian aircraft will depend on the location of the war front, length of runways at the airports, support facilities, availability of fuel and the purpose of the flight.

7.1.1 Assistance During Natural Disasters

The geologic and geographic setting of Pakistan is such that it experiences fewer natural disasters than India or Bangladesh. The most devastating natural disasters are earthquakes, floods, and storms. Geologically, the Baluchistan area is unstable and has experienced a number of earthquakes including two centered around Quetta in 1931 and 1935, one near Gawader in 1947, and a minor tremor in 1974 in the northwest part of Pakistan. In 1965, heavy rains hit the Karachi area, resulting in severe flooding. In 1973, the country suffered the worst floods in its history. On all such occasions, the armed forces were mobilized for relief operations and Air Force aircraft and helicopters were used on relief missions to drop food, clothing and medical supplies over the disaster areas. Pakistan has undergone a major water management program to control the flooding of rivers. The drainage systems of major cities are being improved. The severity of any future, natural disaster is expected to be low. If called upon, PIA is capable of providing assistance to carry medical supplies, relief goods and other assistance in the disaster stricken area of Pakistan.

Except in Quetta, most of the airports in Baluchistan have short runways which will restrict the operation to smaller aircrafts. For any such relief operation, no major conversion of the aircraft is anticipated that would restrict the airline's ability to provide assistance.

7.1.2 Assistance in Handling Internal Disturbances

Pakistan came into being in 1947 but through all these years it still has not attained political stability. The political developments in Pakistan from 1947 to the mid-1980s could be divided into six phases: (1) formation of Pakistan and struggle for survival (1947-51); (2) attempts by the politicians to establish a parliamentary system (1951-58); (3) the influence of the military and civil service on Pakistan's political structure (1958-69); (4) civil war and the secession of East Pakistan as Bangladesh (1969-72); (5) reconciliation and efforts to attain political stability (1972-77); and (6) military regime of General Zia (1978 - to date). After independence the country witnessed a number of civil disturbances in the form of major demonstrations by students, labor strikes, and agitations by religious groups. These disturbances have resulted in violent clashes with police and other security forces. The longest and most serious sequence of these disturbances led to the down fall of President Ayub. In order to subdue the masses, police riot squads used tear gas and shot at the mobs. If the situation exceeded the regular police capability, military reinforcements were used. Other major riots include of the language riots of 1972, Ahmadi and Shia riots of 1953 and 1963, and Ahmadi demonstrations of 1974. During most of these disturbances, the local strength of the police was supplemented by military. On a few occasions, an entire province has been placed under the martial law. If

such disturbances occur in the future, civil aviation may be called upon to help the local security forces by transporting men and material at short notice. No major conversion of aircraft is expected for such functions and PIA is capable of providing assistance to the military.

7.1.3 Assistance in National Defense

From its 500-mile coast line on the Arabian sea, Pakistan extends northeast between Iran and Afghanistan to the west and India to the east. In the north, the portion of the disputed territory of Jammu and Kashmir that is controlled by Pakistan has a common border with the Peoples Republic of China (PRC). Figure 11. Pakistan has a common boundary with Iran for about 500 miles and with Afghanistan for about 1400 miles. In the north along the ridges of the Hindukush and the Pamir ranges, there is a narrow strip of Afghan Territory, Wakhan Corridor which separates Pakistan from the Soviet Union by only a few miles. Access to the Wakhan Corridor is through Baroghil Pass. The boundary line between Pakistan and Afghanistan, called Durand Line, has not been fully accepted by Afghanistan, which has been a major source of conflict between the two countries. In the northeastern part of the country, Pakistan controls about 32,500 square miles of the disputed state of Jammu and Kashmir. India holds the remainder of the State of about 54,000 square miles. From the eastern end of the Pak-Afghan border, a boundary of about 3,000 miles runs between the PRC and Pakistan controlled Jammu and Kashmir, ending at the Karakoram Pass. Major passes and high peaks including 28,250 foot-high K-2 lie in this area. The Pakistan-India cease-fire line runs for about 500 miles from the Karakoram Pass to about eighty miles northeast of Lahore. In southern Pakistan, the Thar Dessert in the Province of Sind is separated

from the salt flats of the Indian Rann of Kutch. This area was the scene of the border conflicts with India in 1965. From the western terminus of the Rann of Kutch boundary, the boundary runs the final fifty miles of the border with India and terminates to an inlet at the Arabian Sea.

The partition of the Indian subcontinent on the basis of religious majority (as India and Pakistan) has been and could again be the cause of bitterness, dissention, and war within the Indian subcontinent. A recent aspect to such deterioration is India's open and Pakistan's secret nuclear strength, which could be used for military purposes against each other. The status of the princely states of Jammu, Kashmir, and Junagarh is still not settled; these issues could erupt in a war situation between the two countries. The Durand Line has not been accepted by Afghanistan, who would like to see this line moved eastward to include the Northwest Frontier Province and most of Baluchistan in Afghanistan. The tribesmen living on the Afghanistan side of the boundary have been sporadically raiding Pakistan areas. This situation intensified after the occupation of Afghanistan by the USSR and emigration of Afghanis to Pakistan due to Russian hostilities. As late as 1974, there were disturbances in Baluchistan and in the Northwest Frontier Province which resulted in widespread arrests and some military action in Baluchistan.

Although Pakistan does not share a border with the USSR, the Soviet Union plays a major role in the geopolitical situation of the region because of its influence on Afghanistan and India. Pakistan has good relations with Iran and with China. The possibility of war exists between India and Pakistan or between Afghanistan and Pakistan; civil aviation may be called upon to assist the military. In Baluchistan, along the Afghan

border, most of the civilian airports could support only smaller aircraft except Quetta which has the longest runway in Pakistan. A large number of troops and small equipment could be mobilized in the region on short notice not only by air but by road and rail also. On the lower tip of Baluchistan, the airports at Gwadar and Pasni could accommodate smaller aircraft but in the rainy season landings and take offs become very difficult at these airports. If troop reinforcement is needed, the alternate means of road transport and water transport (Karachi to Gwadar via the Arabian Sea) are possibilities. In the Northwestern Frontier region along the Afghanistan border, Peshawar offers a major airport that could support major military airlift operations. This region is also connected with Punjab and with upper Baluchistan by road as well as rail systems. The Pakistan border with India runs northeast and, except in the lower Sind area, has several airports and fully developed rail and road systems. The lower Sind region is accessible by roads but these are dirt roads, they become difficult to travel during rainy season.

8.0 POTENTIAL USE OF CIVIL AIRLINES FOR MILITARY PURPOSES

8.1 Potential Military Purposes

As discussed in Section 7.1.3, the potential of war exists between India and Pakistan or between Pakistan and Afghanistan. In either case, PIA aircraft could be used to augment the military's troop and material carrying capabilities. Fokker aircrafts could be used for carrying wounded from the battlefields and dropping supplies. Airbuses and Boeing 747 combi versions could haul armoured cars and jeeps, etc. Depending on the location of the war zone, the limiting factor could be runways, ground support facilities and availability of fuel at the airport.

8.2 Response Planning

Response planning involves the speed with which civil airlines/air services could be ready to respond to military needs. Although PIA is a civilian airline, many of its staff members are ex-Pakistan Air Force personnel who perform operational functions. Also, a majority of the staff has direct experience in real war emergencies in 1965 and 1971 and this staff is expected to continue with the Corporation for the next several years. PIA has several active Air Force senior officials on its staff who bring military discipline to the organization. All these factors positively impact PIA's ability to help the military during national emergencies.

8.3 Readiness Posture

In civilian organizations, the readiness posture may differ at various levels of the organization. In a war emergency, supervisory, management, and upper technical staff seem ready

to respond. During the early stages of war, however, the lower staff may be less able to respond appropriately to emergency situations. For example, in 1982 a DC-10 caught fire at the Karachi hangar. It is reported that available fire fighting equipment was found to be inadequate to put out the fire. The maintenance crew were able to manually remove the nearby Fokkers to save them. PIA requested that Masroor Air Force Base send their fire fighting engines, but when they arrived, the security guard at the gate did not allow them to enter because they had no entry pass. Meanwhile, because of all these delays, the DC-10 suffered major loss from the fire. The cause of the fire could not be confirmed as sabotage or negligence. It could not be confirmed from public sources whether PIA provides emergency response training to its lower staff; they could be a weak link at least during the initial stages of war.

8.4 Personnel Experience

PIA is now hiring a large number of pilots directly and the ratio between civilian and ex-Air Force pilots working with PIA is decreasing. The Air Force College of Aeronautical Engineering at Karachi provides the initial basic courses and training to both military and civilian would-be civil aviation employees. These courses are supplemented by specialized training at the PIA Training Center. At the present time, possibly 20 percent of the pilots and aeronautical engineers have some military experience. As long as their duties and functions in an emergency are similar to their peace-time operations (with minor changes in the operating environment), the lack of war experience for the majority of the PIA staff will not pose a problem for their operational effectiveness. It is reported that the PIA technical staff is generally innovative, daring, and performs well in civilian emergency situations.

8.5 Effectiveness and Confidence Levels

Although it is reported that civil airline employees do not receive specific training to prepare them to participate in military operations, they seem to be generally well prepared for the roles that they may be required to perform during war emergencies. The overall effectiveness of the organization is considered better than average.

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Table 1 LIST OF LIBRARIES USED FOR DATA COLLECTION

TWA	New York
Pan Am	New York
UNO	New York
Douglas Aircraft Co.	Long Beach
Library of Congress	Washington, D.C.
Pakistan Embassy	Washington, D.C.
United States Central Intelligence Agency	Washington, D.C.
JPRS - CIA	Arlington
University of California	Berkeley
Southeast Asian Studies	Berkeley
International Civil Aviation Organization	Montreal
International Association of Travel Agents	Montreal
Air & Space Law-McGill University	Montreal
Woodward-Clyde Consultants	Walnut Creek
Woodward-Clyde Consultants	Wayne

Table 2 LIST OF PAKISTAN NEWSPAPERS WITH DATE OF COVERAGE

DAWN:	Oct. '55, Aug-Oct. '65, Nov.-Dec. '70, Sept.-Dec. '71, July '74.
IMROZ:	Oct. '55, Aug-Oct. '65, Nov.-Dec. '70, Sept.-Dec. '71, Aug.-Sept. '73, July '74.
JUNG:	Oct. '55, Aug.-Oct. '65, Nov.-Dec. '70, Sept.-Dec. '71, Jul. '74.
PAKISTAN TIMES:	Oct. '55, Aug.-Oct. '65, Nov.-Dec. '70, Sep.-Dec. '71, Aug.-Sep. 73, Jul. '74.

General Coverage

Khayber Mail
Mashriq
Nava-e-Vaqt

AD-A157 246

CIVIL AIRLINES/AIR SERVICES IN BANGLADESH INDIA AND
PAKISTAN VOLUMES 1 THRU 4(U) WOODWARD-CLYDE CONSULTANTS
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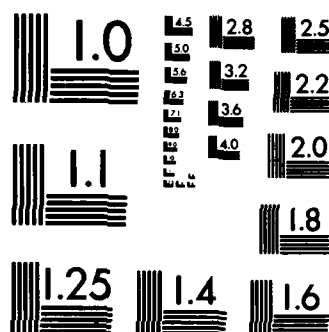
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 3. KEY PERSONNEL OF PAKISTAN INTERNATIONAL AIRLINES

Board of Directors

**Maj. Gen. (Retd) M. Rahim Khan,
Secretary General Defence &
Chairman, PIAC.**

**Air Chief Marshal M. Anwar Shamim,
Chief of the Air Staff.**

Mr. Ghulam Faruque.

**Mr. H. U. Beg,
Secretary Finance.**

**Dr. Moinuddin Baqai,
Secretary Planning.**

**Mr. M. R. Khan,
Chairman, Pakistan Banking Council.**

**Mr. A. Jamil Nishtar,
Chairman,
Agricultural Development Bank of
Pakistan.**

**Mr. D. M. Qureshi,
Managing Director,
Bankers Equity Limited.**

**AVM Khurshid Anwar Mirza,
Director General,
Civil Aviation Authority.**

**Mr. M. M. Salim,
Chairman, PIA Investments Limited.**

**AVM Wiqar Azim,
Managing Director, PIAC.**

**Mr. Mahmud Alam,
Secretary.**

Management

**AVM Wiqar Azim,
Managing Director.**

**Mr. S. Ajaz Ali,
Director Corporate Planning.**

**Mr. Fazal Ahmad,
Director Engineering & Maintenance.**

**Mr. Arshad Mahmud,
Director Finance.**

**Mr. M. Nawaz Tiwana,
Director Customer Services.**

**Brig. Shamim Yasin Manto,
Director Administration.**

**Mr. Khursheed Anwar,
Director Marketing.**

**Captain S. S. Akbar,
Director Flight Operations.**

**Air Commodore (Retd) Mumtaz Ali,
Director Stores & Purchases.**

**Brig. (Retd) S. M. H. Atif,
Director Sports.**

**Captain M. Ishaq,
Director General Services.**

Table 4. PROFILE OF SELECTED KEY PERSONNEL

Chairman:	Maj. Gen. (Retired) Rahim Khan. He is also Secretary Ministry of Defense.
Managing Director:	Air Marshal Wigar Azim. He is still an active officer of Pakistan Air Force.
Director, Corporate Affairs:	Sayyid Ajaz Ali. He has been with the company for over 25 years and at one time was in charge of Engineering & Maintenance. He is an engineer by profession.
Director, Engineering & Maintenance:	Fazal Ahmed. He, like Ajaz Ali, has been with the company for over 25 years and an engineer by profession.
Director, Financial Services:	Arshad Mahmud. He has been with the company for over 14 years and is a CPA.
Director, Customer Services:	M. Nawaz Tiwana. He has been with the company for about 20 years.
Director, Administration:	Brig. Yasin Minto. He was formerly a one-star General in the Army.
Director, Stores & Purchases:	Air Cmodr Mumtaz Ali. He is an ex-Pakistan Air Force man.
Director, Flight Operations:	Capt. Akbar. He has been a pilot with PIA for over 25 years.

Table 5. PAKISTAN INTERNATIONAL AIRLINES FLEET

<u>Type</u>	<u>Serial No.</u>	<u>Date of Manufacture</u>	<u>Date of Delivery To This Operator</u>
AB A300B4-203	96	11/79	03/80
	98	01/80	03/80
	99	02/80	04/80
	114	06/80	08/80
	314	04/83	04/83
	315	07/83	07/83
Boeing B707-373C -340C	18991	10/65	06/71
	19866	08/68	08/68
	19286	09/67	09/67
	20488	12/70	12/70
	-351B 19636	07/68	05/77
	19635	05/68	07/77
	-323C 19576	06/68	01/82
B747-282B	20928	06/74	04/76
	21035	10/75	04/76
	-230B Combi 21825	07/79	07/79
	-240B Combi 22077	03/80	03/80
Fokker F27-200	10164	12/60	01/61
	10187	10/61	10/61
	10278	06/65	07/65
	10307	09/66	09/66
	10288	11/65	04/73
	10243	01/64	01/79
	10230	07/63	06/79
	10207	07/62	08/81
	-400 10355	02/68	03/68
MDD DC-10-30	46931	03/74	03/74
	46940	04/74	04/74
	47889	08/76	08/76
	47868	05/75	05/83

Table 6. PAKISTAN GOVERNMENT FLEET

<u>Type</u>	<u>Serial No.</u>	<u>Date of Manufacture</u>	<u>Date of Delivery To This Operator</u>
<u>Karachi</u>			
(6) DHC-2 Beavers		(Unknown)	
(8) Cessna A185F			
(10) Fletcher Fu-24-950			
<u>Lahore</u>			
(2) Cessna A185F			
(2) Fletcher Fu-24-950			

^{1/} Different sources disagree on the actual ownership and operation of this fleet. They may be operated and owned by a government-backed company called Agricultural Aviation Ltd.

Table 7. FLYING CLUBS FLEET

<u>Type</u>	<u>Serial No.</u>	<u>Date of Manufacture</u>	<u>Date of Delivery To This Operator</u>
<u>Karachi</u>			
(2) Cessna 185		(Unknown)	
(2) 150			
(1) 206			
(1) 310			
(1) Piper Cherokee 140 (PA-28)			
<u>Lahore</u>			
(2) Cessna 185			
(1) 150			
(1) 172			
(1) 182			
<u>Multan</u>			
(2) Cessna 172			
(1) 150			
(1) 180			
<u>Rawalpindi</u>			
(2) Cessna 150			
(1) 180			
(1) Piper Super Cub 150 (PA-18)			

Table 8. GENERAL AIRCRAFT DATA—DeHAVILLAND DHC-2 BEAVER

Aircraft Type: DeHavilland DHC-2 Beaver

Models: --

Engine: One Pratt & Whitney R-985 Wasp Junior (9 cylinder radial air-cooled engine)

Dimensions:	Wing Span	Length	Height
	48 ft.	30 ft. 4 in.	9 ft.

Weights (lbs):	MXTOW	Empty	MXLND	MPYLD	Fuel Cap.
	5,200	3,000	5,100	2,100	635

Seats:	Maximum	Typical
	7	7

Cargo Capability: Door permits pieces of freight as long as 10 ft. to be loaded. Also a 45 gallon drum.

Maximum Range - With Maximum Payload: 483 n. mi.

Runway Requirements: Minimum Runway Length - 1,015 ft.

Special Features or Restrictions: Can be equipped with floats for water operations. Short takeoff, unimproved runway capability.

Table 9. GENERAL AIRCRAFT DATA--FLETCHER FU24-950

Aircraft Type: Fletcher FU24-950

Models: --

Engine: One AVCO Lycoming IO-720-A1A (piston engine)

Dimensions:	Wing Span	Length	Height
	42 ft.	31 ft. 10 in.	9 ft. 4 in.

Weights (lbs):	MXTOW	Empty	MXLND	MPYLD	Fuel Cap.
	4,860	2,620	N/A	2,320	450

Seats:	Maximum	Typical
	9 (utility version)	2 (agricultural version)

Cargo Capability: 2,320 lbs. in agricultural configuration
1,400 lbs. in utility version

Maximum Range - 383 n. mi.

Runway Requirements: Minimum Runway Length - 1,280 ft.

Special Features or Restrictions: This aircraft is intended primarily for agricultural spraying and is probably configured as such in the Pakistan fleet. It is available in a utility version, but must be purchased that way. The agricultural version can not easily be field-converted to a utility version.

Table 10. GENERAL AIRCRAFT DATA--SMALL AIRCRAFT

<u>Manufacturer</u>	<u>Model</u>	<u>Description</u>
Cessna	150	2 seat single-engine monoplane
	172,182	4 seat single-engine monoplane
	180,185	6 seat single-engine monoplane passenger, agriculture applications
	206	6 seat single-engine passenger, utility monoplane
	310	4-5 seat twin-engine monoplane
Piper	Super Cub 150 (PA-18)	2 seat single-engine monoplane
	Cherokee 140 (PA-28)	2-4 seat single-engine monoplane

TABLE 11. CIVILIAN AND MILITARY AIRPORTS OF PAKISTAN

Name/Code and Location of Airport	Geographical Coordinates	Runway Dimensions (ft)	Pavement Type
Civilian Airports			
Kundian, Chasma	N3225.4/E07127.4	3,500x80	Asphalt
Chilas, Chilas	N3225.7/E07405.0	4,500x100	Asphalt
CJL, Chitral	N3553.2/E07147.7	5,800x100	Asphalt
DSK, D.I. Khan	N3154.6/E07053.8	5,000x75	Asphalt
Faisalabad, Lyallpur	N3122.2/E07259.9	9,100x100	Concrete
		9,300x100	Asphalt
GIL, Gilgit	N3555.2/E07420.2	5,400x100	Asphalt
HDD, Hyderabad	N2519.3/E06821.8	7,000x100	Asphalt
Chakla, Islamabad	N3336.8/E07306.3	8,450x150	Concrete
		9,000x150	Concrete
Jacobabad, Jacobabad	N2816.8/E06827.1	10,000x150	Asphalt
JIW, Jiwani	N2507.7/E06148.5	5,413x164	Gravel
OKT, Kohat	N3334.4/E07126.4	8,071x150	Concrete
LHE, Lahore	N3131.8/E07424.2	9,000x150	Concrete/ Asphalt
Mangla, Mangla	N3303.0/E07338.3	5,000x100	Asphalt
Mianwali, Mianwali	N3233.0/E07133.0	10,000x150	Concrete
MJD, Moenjodaro	N2720.2/E06808.5	6,500x100	Asphalt
Mux, Multan	N3012.2/E07125.1	9,000x150	Asphalt
WNS, Nawabshah	N2613.2/E06823.5	9,000x150	Concrete
PJG, Punjgur	N2657.0/E06408.4	5,000x150	Gravel
PSI, Pasni	N2517.0/E06323.0	9,000x100	Concrete/ Bitumen
PEW, Peshawar	N3359.7/E07131.0	9,000x150	Asphalt
Quetta	N3015.2/E06656.3	6,540x150	Asphalt
Samungli		12,000x150	Asphalt
RYK, Rahim Yar Khan	N2825.0/E07018.0	4,500x100	Brick
SDT, Saidu Sharif	N3448.8/E07221.2	6,270x160	Asphalt
KDU, Skardu	N3520.0/E07532.1	6,600x110	Asphalt
SUL, Sui	N2838.0/E06910.0	5,000x100	Soil

TABLE 11 CIVILIAN AND MILITARY AIRPORTS OF PAKISTAN (Continued)

Name/Code and Location of Airport	Geographical Coordinates	Runway Dimensions (ft)	Pavement Type
SKZ, Sukkur	N2743.4/E06847.4	9,000x100	Asphalt
Sargodha, Sargodha	N3359.5/E07236.5	5,600x100	Asphalt
Turbela, Turbela Dam	N3203.0/E07240.0	9,000x150	Asphalt
Turbat, Turbat	N2559.0/E06301.9	6,000x100	Asphalt
Wana, Wana	N3218.3/E06934.3	4,900x160	Concrete
<u>Military Airports</u>			
Chandhar (AFB) Chandhar	N3205.8/E07347.7	9,000x120	Asphalt
Jacobabad (Military) Jacobabad	N2186.8/E06827.1	10,000x150	Asphalt
Masroor (AFB) Karachi	N2454.0/E06657.0	9,000x200	Asphalt
		9,000x115	Concrete
Walton (Air Force/Army Station) Lahore	N3130.0/E07420.0	6,230x150	Concrete
Mianwali (AFB) Mianwali	N3233.8/E07134.4	10,150x100	Asphalt/ Concrete
Murid (AFB) Murid	N3254.7/E07246.5	8,858x98	Asphalt
Dhamil (Army Base) Qasim	N3333.7/E07301.9	3,300x150	Asphalt
		6,690x150	Asphalt
Shorkot Road (AFB) Rafiqui	N3045.8/E07117.0	10,000x160	Asphalt
Sargodha (AFB) Sargodha	N3203.0/E07240.0	7,940x140	Asphalt
		10,050x150	Asphalt
<u>Proposed Civil Airports</u>			
Bahawalpur			
Kohat			
Okara			
Ormara			

Table 13. CIVILIAN AIRPORTS—GWADAR

Airport Name/Code: GWD

Location:	(City)	(Geo. Coordinates)
	Gwadar	N 2513.8 / E 06220.3

Temperature Data:	N/A	Field Elevation:	96.ft. MSL
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Runways:	Orientation -	06/24
	Length/Width -	5,000 x 100
	Surface Type/Strength -	Asphalt

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

Table 12. CIVILIAN AIRPORTS—KARACHI

Airport Name/Code: Drigh Road Civil (KHI)

Location: (City) Karachi (Geo. Coordinates) N 2454.3 / E 06709.4

Temperature Data: Field Elevation: 100.ft. MSL
Average Daily - Maximum 84°F
- Minimum 72°F

Runways: Orientation - 07L/25R 07R/25L
Length/Width - 10,500 x 150 7,500 x 150
Surface Type/Strength - Concrete Bitumen

NAVAIDS/Lighting: VOR, VOR-DME and NDB, LOM, ILS/Radar, ATC Tower approach control

Maintenance Facilities:

Operator - Caltex, Pakistan, Ltd.
Services Available - major maintenance facilities, PIA Training Center
including simulator training

Fuel Facilities:

Types Available - Grade 80, Grade 100 low lead, Jet A-1
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	A300B4-203	6
	B707-300C	5
	B707-300B	2
	B747-200B	2
	B747-200B Combi	2
	F27	9
	DC-10-30	4
	DHC-2	6
	FU24	10
	Cessna 185	10
	Cessna 150	2
	Cessna 206	1
	Cessna 310	1

Special Features or Comments:

Table 14. PERSONNEL

Pilots	500
Cabin Attendants	1,200
other Cockpit Personnel	200
Maintenance and Overhaul Personnel	5,500
Support Personnel-Sales, Ticketing, and Promotional	2,600
other Personnel	<u>10,000</u>
TOTAL	20,000

Table 15. COMMUNICATION SYSTEM—FLEET AVIONICS

Communications

HF Radio
VHF Radio
Intercom
Public Address System
HF SSB Radio

Flight Control System

Autopilot
Flight Director
Flight Data and Voice Recorder
Avionics Management System
Heading Repeater

Navigation Equipment

VOR/LOC Glide Slope Receiver
ILS
Marker Beacon
DME
ADF
VHF Navigation Unit
INS
Ground Proximity Warning System

Instrumentation & Others

Compass
HSI
VSI
Altimeter
TAS Computer
Weather Radar
ATC Transponder
Navigation Computer

Collins, Smiths Industries, Marconi, Bendix, Sperry Flight Systems, Honeywell, King Radio, Sunstrand, Garrett, and Delco mainly supply these items.

Table 16. WIDE BODY HANGAR AT KARACHI

Hangar

The main hangar is a steel structure with a box-type design with insulated roof.

Outside dimensions

width	depth	height
137 m	96 m	40 m

Inside dimensions

width	depth	height
135 m	93.23 m	26 m

Area available

12360 m²

Accommodation

One DC-10 or A-300 and one B-747 at a time with complete docking.

Mezzanine floor

A mezzanine floor 20m deep runs along the whole width of the hangar. The height of the mezzanine floor is 6.55 m coinciding with the height of

the cabin floor of the aircraft in jacked-up position. The mezzanine will be used mainly for seat storage and it will provide a direct access from the aircraft to the aircraft furnishing section.

Doors

The hangar is provided with 28 m high, electrically-operated steel doors, mounted on rails.

Walls

The side walls of the Hangar have been clad with insulated steel sheet panels.

Roof

The roof is covered with galvanised steel panels incorporating insulating material. A false ceiling of wire netting to avoid bird menace.

Cranes

3 bridge-cranes of capacity 10 to 20 tons have been installed to cover the entire hangar and a number of mono-rails in shop/store areas.

Docks

Complete overhaul docking including the suspended tail docks is provided for Boeing 747, as well as for DC-10, for quick and easy access to all parts of the aircraft. The DC-10 Dock is adaptable to A-300 Aircraft.

Underground services

63 underground pits with service points for compressed air, AC, DC and 400 Hz power supplies, purging of fuel tanks, cold water, hot water and static electric grounding are provided all over the hangar floor.

Fire fighting system

A built-in Foam dilute spray system operated through Foam Guns to cover the entire Hangar, coupled with automatic Fire Detection and Alarm system.

Lighting

The hangar is well-illuminated by high-pressure sodium vapour flood lights. The intensity of lighting on the Hangar Floor is 40Lux.

Table 16. WIDE BODY HANGAR AT KARACHI (continued)

Support workshops

The main hangar has a number of support workshops, such as Sheet Metal, Plastic Repair, Aircraft Cabin Furnishing, Cleaning and Painting, Carpentry, Ground Support Equipment, Tool Stores and the necessary equipment to provide various services required in the Hangar. All these facilities are housed in the side and main annexe building.

run-up bays have been provided with blast deflectors, to divert engine exhaust and attenuate the noise. The parking/maintenance bays and run-up points are being provided with underground pits with service points for compressed air, AC and 400 Hz power supplies start air and water. The apron is well-illuminated with tower-mounted high-pressure sodium vapour flood lights.

Spare parts stores

High Mechanised Storage System having 65,000 bins is capable of storing 2,00,000 different small parts in addition to raw material stores etc.

Amenities and office space

In addition to the workshops, a number of amenities, such as a prayer hall, change-over rooms, dispensary, canteen, technical library, auditorium and offices for supervisory and administrative staff are provided in the annexe building.

Apron

An apron covering an area of about 120773m² has been constructed in the front and on the eastern side of the hangar. It will provide eight additional parking/maintenance bays and two run up bays. The

TABLE 17. PAKISTAN AIR FORCE FLIGHT EQUIPMENT

Name and Number of Aircraft	Type	Made In	Quantity
<u>Attack, Bomber, Fighter, Interceptor, Reconnaissance Aircraft</u>			
A-5 Phantom	Fighter/Bomber	USA	(Ordered)
B-57B Canberra	Bomber	UK	11
F-6 Farmer	Fighter/Bomber	China	120
F-16 A/B	Interceptor/Attack	USA	34/6
FT-5 (MiG-17U)	Fighter	China	15
FT-6	Fighter	China	10
Mirage 111EP/111RP	Interceptor	France	17/13
Mirage 111DP	Reconnaissance/ Trainer	France	3
Mirage 5PA	Fighter/Bomber	France	28
Mirage 5 PA2	Fighter/Bomber	France	30
<u>Transport Aircraft</u>			
C-130B/E Hercules		USA	12
F27-200 Friendship		USA	2
L-100-20		USA	1
<u>Trainer Aircraft</u>			
Cessna 172N		USA	4
Cessna T37B		USA	40
FT5/FT-6		China	20/16
MF1-17B Mushaa		Sweden	60
Mirage 5DP		France	2

TABLE 17. PAKISTAN AIR FORCE FLIGHT EQUIPMENT (Continued)

Type	Serial No.	Date of Manufacture	Date of Delivery To This Operator
<u>Trainer Aircraft (continued)</u>			
Mirage DPA2		France	2
T33A/RT-33A		USA	10/+5
T-37B		USA	40
<u>Other Aircraft</u>			
Beach Baron/Travel Air		Liaison	1/1 ordered
Falcon 20	VIP	France	1
HH-43B Huskee	SAR	USA	4
SA-330J Puma	VIP	France	1
Seneca II	Liaison		2
<u>Helicopters</u>			
Aloutte III		France	14
Bell 47G		USA	12

TABLE 18. PAKISTAN ARMY AND NAVY FLIGHT EQUIPMENT

Name and Number of Aircraft	Made In	Quantity
PAKISTAN ARMY AIRCRAFT		
AH-1S Cobra	USA	12
Cessna O-1E Bird Dog	USA	50
Saab (PAC) Mushaq	Sweden	24
Rhein FTB 337	W. Germany	24
<u>Helicopters</u>		
Bell 47G	USA	20
Mi-8 Hip	USSR	12
SA316B Aloutte III	France	20
SA330 Puma	France	35
PAKISTAN NAVY AIRCRAFT		
Breguet Br 1150/Atlantic MK1	France	3
<u>Helicopters</u>		
SA319B Aloutte III Astazon	France	4
Westland Sea King MK45	France	6

TABLE 19 MILITARY TRANSPORT AND CIVILIAN AIRCRAFT OF PAKISTAN

Name of Aircraft	Number of Aircraft	Passenger Capacity	Freight Capacity (lbs.)	Minimum Runway Requirements (ft.)	Range (miles)	Maximum Speed (mph)
<u>Military Transport Aircraft</u>						
C-130 BE Hercules	12	92 troops or 64 paratroops	43,400	--	2487	375
Fokker F27-200	2	48 troops or 46 paratroops	14,193	2310	1197	302
L-100-20	1	92 troops or 64 paratroops	43,400	--	2483	375
<u>Pakistan International Airlines Aircraft</u>						
Airbus A300B4	6	336	70,547	5445	2900	528
Boeing 707	7	189	96,000	8000	4235-6160	535
Boeing 747	4	B-480 B-Combi-226	140,000 160,000	6000	5200	562
Fokker F27-200	9	48	14,193	2310	1197	302
MDD DC-16-30	4	380	106,550	5350	4000	--

Appendix B
Pakistan Civilian Airports

AIRPORT FACILITIES
Pakistan

Airport Name/Code: Kundian

Location:	(City)	(Geo. Coordinates)
	Chashma	N 3225.4 / E 07127.4

Temperature Data: N/A	Field Elevation: 645 ft. MSL
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Runways:	Orientation -	06/24
	Length/Width -	3,500 x 80
	Surface Type/Strength -	Asphalt

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code:

Location:

(City)
Chilas

(Geo. Coordinates)
N 3525.7 / E 07405.0

Temperature Data: N/A

Field Elevation: 4,150.ft. MSL

Runways: Orientation - 10/28
Length/Width - 4,500 x 100
Surface Type/Strength - Asphalt

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:

Types

Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: CJL

Location: (City) (Geo. Coordinates)
Chitral N 3553.2 / E 07147.7

Temperature Data: N/A Field Elevation: 4,000.ft. MSL

Runways: Orientation - 02/20
Length/Width - 5,800 x 100
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: Radio (PIA)

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: DSK

Location:	(City)	(Geo. Coordinates)
	Dera Ismail Khan	N 3154.6 / E 07053.8

Temperature Data:	N/A	Field Elevation:	565.ft. MSL
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Runways:	Orientation -	12/30
	Length/Width -	5,000 x 75
	Surface Type/Strength -	Asphalt

NAVAIDS/Lighting: NDB

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: Faisalabad (LYP)

Location: (City) (Geo. Coordinates)
Lyallpur N 3122.2 / E 07259.9

Temperature Data: N/A Field Elevation: 607.ft. MSL

Runways:	Orientation -	03L/21R	03R/21L
	Length/Width -	9,100 x 100	9,300 x 100
	Surface Type/Strength -	Concrete	Asphalt

NAVAIDS/Lighting: Runway Lights, ATC Tower, NDB

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: GIL

Location: (City) (Geo. Coordinates)
Gilgit N 3555.2 / E 07420.2

Temperature Data: N/A Field Elevation: 4,770.ft. MSL

Runways: Orientation - 07/25
Length/Width - 5,400 x 100
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: ATC Tower

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: HDD

Location: (City) (Geo. Coordinates)
Hyderabad N 2519.3 / E 06821.8

Temperature Data: Field Elevation: 130.ft. MSL
Average Daily - Maximum 93°F
- Minimum 68°F

Runways: Orientation - 02/20
Length/Width - 7,000 x 100
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: NDB, ATC Tower

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities: Unknown Type of Jet Fuel

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

Additional Facilities: Civil Aviation Training Institute

PAKISTAN AIRPORTS

Airport Name/Code: Chaklala (ISB)

Location: (City) (Geo. Coordinates)
Islamabad N 3336.8 / E 07306.3

Temperature Data: Field Elevation: 1,665.ft. MSL
Average Daily - Maximum 90°F
- Minimum 40°F

Runways: Orientation - 09/27 12/30
Length/Width - 8,450 x 150 9,000 x 150
Surface Type/Strength - Concrete Concrete

NAVAIDS/Lighting: ATC Chakala Tower, Cherat Approach Control, RW 12: Rw lights; VASI; rw center line; rw end identifier lights (REIL). RW 30: Rw lights; high intensity rw lights (HIRL); high intensity approach lights; sequenced flashing lights; VASI, REIL, rw center line lights.

Maintenance Facilities:

Operator - PIA
Services Available - Medium size maintenance facility including Fokker F27 maintenance, oxygen

Fuel Facilities:

Types Available - Grade 80, Grade 100 low lead, unknown jet
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	Cessna 150	2
	Cessna 180	1
	PA-18 (Super Cub)	1

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: JIW

Location: (City) (Geo. Coordinates)
Jiwani N 2503.7 / E 06148.5

Temperature Data: N/A Field Elevation: 184.ft. MSL

Runways: Orientation - 02/20
Length/Width - 5,413 x 164
Surface Type/Strength - Gravel

NAVAIDS/Lighting: VOR, DME, and NDB

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: OHT

Location:	(City)	(Geo. Coordinates)
	Kohat	N 3334.4 / E 07126.4

Temperature Data:	N/A	Field Elevation:	1,650 ft. MSL
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Runways:	Orientation -	14/32
	Length/Width -	8,071 x 150
	Surface Type/Strength -	Concrete

NAVAIDS/Lighting: Portable lights

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments: PIA feeder service to start by mid-1985

PAKISTAN AIRPORTS

Airport Name/Code: LHE

Location: (City) (Geo. Coordinates)
Lahore N 3131.8 / E 07424.2

Temperature Data: Field Elevation: 700.ft. MSL
Average Daily - Maximum 89°F
- Minimum 61°F

Runways: Orientation - 18/36
Length/Width - 9,000 x 150
Surface Type/Strength - Concrete/Asphalt

NAVAIDS/Lighting: Runway lights; approach lights, VASI, VOR-DME; NDB;
LOM; VDF; ILS/Radar; ATC Tower, approach control

Maintenance Facilities:

Operator - PIA
Services Available - Light maintenance facilities including Fokker
F27 maintenance

Fuel Facilities:

Types Available - Jet fuel type unknown except Jet A-1
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	FU24	2
	Cessna 185	4
	Cessna 150	1
	Cessna 172	1
	Cessna 182	1

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code:

Location:	(City) Mangla	(Geo. Coordinates) N 3303.0 / E 07338.3
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Temperature Data: N/A

Field Elevation: 952.ft. MSL

Runways:	Orientation -	13/31
	Length/Width -	5,000 x 100
	Surface Type/Strength -	Asphalt

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments: PIA will serve this area airport by mid-1985

PAKISTAN AIRPORTS

Airport Name/Code: MJD

Location: (City) (Geo. Coordinates)
Moenjodaro N 2720.2 / E 06808.5

Temperature Data: N/A Field Elevation:

Runways: Orientation - 08/26
Length/Width - 6,500 x 100
Surface Type/Strength - Asphalt

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: MUX

Location: (City) (Geo. Coordinates)
Multan N 3012.2 / E 07125.1

Temperature Data: Field Elevation: 413.ft. MSL
Average Daily - Maximum 92°F
- Minimum 66°F

Runways: Orientation - 18/36
Length/Width - 9,000 x 150
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: Runway lights; portable lights; VOR; NDB; ATC TOWER

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Jet A-1
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	Cessna 172	2
	Cessna 150	1
	Cessna 180	1

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: WNS

Location: (City) (Geo. Coordinates)
Nawabshah N 2613.2 / E 06823.5

Temperature Data: N/A Field Elevation:

Runways: Orientation - 02/20
Length/Width - 9,000 x 150
Surface Type/Strength - Concrete

NAVAIDS/Lighting: Runway lights; VOR; NDB; UHF/DF Homer; ATC Tower

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Grade 80, Grade 100 low lead, and Jet A-1
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: PJG

Location: (City) (Geo. Coordinates)
Punjabur N 2657.0 / E 06408.4

Temperature Data: N/A Field Elevation:

Runways: Orientation - 14/32
Length/Width - 5,000 x 150
Surface Type/Strength - Gravel

NAVAIDS/Lighting: VOR; NDB

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: PSI

Location:	(City)	(Geo. Coordinates)
	Pasni	N 2517.0 / E 06323.0

Temperature Data:	Field Elevation:
Average Daily - Maximum 87°F	10 ft. MSL
- Minimum 67°F	

Runways:	Orientation -	06/24
	Length/Width -	9,000 x 100
	Surface Type/Strength -	Concrete/Bitumen

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: PEW

Location: (City) (Geo. Coordinates)
Peshawar N 3359.7 / E 07131.0

Temperature Data: Field Elevation: 1,161 ft. MSL
Average Daily - Maximum 85°F
- Minimum 59°F

Runways: Orientation - 17/35
Length/Width - 9,000 x 150
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: Portable lights; approach lights; HIRL; high intensity
approach lights: VASI; REIL

Maintenance Facilities:

Operator -
Services Available - Light maintenance available

Fuel Facilities:

Types Available - Oxygen and Fuel Jet A-1
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	Cessna 150	1
	Cessna 180	1

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: Samungli (UET)

Location: (City) (Geo. Coordinates)
Quetta N 3015.2 / E 06656.3

Temperature Data: N/A Field Elevation: 5,250 ft. MSL

Runways:	Orientation -	06/24	13/31
	Length/Width -	6,540 x 150	12,000 x 150
	Surface Type/Strength -	Asphalt	Asphalt

NAVAIDS/Lighting: VOR-DME; NDB; ATC Tower

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Grade 80, Grade 100 low lead, Jet A-1
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
	Cessna 150	1

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: RYK

Location: (City) (Geo. Coordinates)
Rahim Yar Khan N 2825.0 / E 07018.0

Temperature Data: N/A Field Elevation: 271 ft. MSL

Runways: Orientation - 04/22
Length/Width - 4,500 x 100
Surface Type/Strength - Brick

NAVAIDS/Lighting: VOR; NDB

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: SDT

Location: (City) (Geo. Coordinates)
Saidu Sharif N 3448.8 / E 07221.2

Temperature Data: N/A Field Elevation: 3,000 ft. MSL

Runways: Orientation - 05/23
Length/Width - 6,270 x 160
Surface Type/Strength - Asphalt

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: KDU

Location:	(City)	(Geo. Coordinates)
	Skardu	N 3520.0 / E 07532.1

Temperature Data: N/A

Field Elevation: 7,600 ft. MSL

Runways:	Orientation -	15/33
	Length/Width -	6,600 x 110
	Surface Type/Strength -	Asphalt

NAVAIDS/Lighting: ATC Tower

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: SUL

Location: (City) (Geo. Coordinates)
Sui N 2838.0 / E 06910.0

Temperature Data: N/A Field Elevation: 763 ft. MSL

Runways: Orientation - 01/19
Length/Width - 5,000 x 100
Surface Type/Strength - Soil

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: SKZ

Location:	(City)	(Geo. Coordinates)
	Sukkur	N 2743.4 / E 06847.4

Temperature Data:	N/A	Field Elevation:	191 ft. MSL
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Runways:	Orientation -	14/32
	Length/Width -	9,000 x 100
	Surface Type/Strength -	Asphalt

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Jet A-1 Fuel
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code:

Location: (City) (Geo. Coordinates)
 Turbela Dam N 3359.5 / E 07236.5

Temperature Data: N/A Field Elevation: 1,114 ft. MSL

Runways: Orientation - 07/25
 Length/Width - 5,600 x 100
 Surface Type/Strength - Asphalt

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code:

Location:

(City)
Turbat New

(Geo. Coordinates)
N 2559.0 / E 06301.9

Temperature Data: N/A

Field Elevation: 175 ft. MSL

Runways: Orientation - 08/26
Length/Width - 6,000 x 100
Surface Type/Strength - Asphalt

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Unknown Jet Fuel Type
Storage Volume -
Delivery System -

Based Aircraft:

Types

Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code:

Location:

(City)
Wana

(Geo. Coordinates)
N 3218.3 / E 06934.3

Temperature Data: N/A

Field Elevation: 4,550 ft. MSL

Runways: Orientation - 09/27
Length/Width - 4,900 x 160
Surface Type/Strength - Concrete

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:

Types

Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code:

Location:	(City)	(Geo. Coordinates)
	Jacobabad	N 2816.8 / E 06827.1

Temperature Data:	Field Elevation:
Average Daily - Maximum 95°F	180 ft. MSL
- Minimum 66°F	

Runways:	Orientation -	15/33
	Length/Width -	10,000 x 150
	Surface Type/Strength -	Asphalt

NAVAIDS/Lighting: NDB; portable runway lights

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments: Will become operational by the end of 1985

PAKISTAN AIRPORTS

Airport Name/Code:

Location:

(City)
Mianwali

(Geo. Coordinates)
N 3233.0 / E 07133.0

Temperature Data: N/A

Field Elevation: 670 ft. MSL

Runways: Orientation - 06/24
Length/Width - 10,000 x 150
Surface Type/Strength - Concrete

NAVAIDS/Lighting: Flares

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Jet Fuel A-1
Storage Volume -
Delivery System -

Based Aircraft:

Types

Number

Special Features or Comments: Civil Airport will be functional by mid-1985

PAKISTAN AIRPORTS

Airport Name/Code:

Location: (City) (Geo. Coordinates)
Surgodha N 3203.0 / E 07240.0

Temperature Data: N/A Field Elevation: 614 ft. MSL

Runways: Orientation - 14/32
Length/Width - 9,000 x 150
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: High intensity runway lights (HIRL)

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Jet 4 (military specification JP-4 fuel);
other fuel but type unknown)
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments: Civil Airport facilities will be operational
by the end of 1985

Appendix C
Pakistan Military Airports

PAKISTAN AIRPORTS

Airport Name/Code: Chandhar (Air Force Base)

Location:	(City)	(Geo. Coordinates)
	Chandhar	N 3205.8 / E 07347.7

Temperature Data:	N/A	Field Elevation:	620 ft. MSL
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Runways:	Orientation -	04/22
	Length/Width -	9,000 x 120
	Surface Type/Strength -	Asphalt

NAVAIDS/Lighting:

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: Jacobabad (Military)

Location: (City) (Geo. Coordinates)
Jacobabad N 2816.8 / E 06827.1

Temperature Data: N/A Field Elevation: 180 ft. MSL

Runways: Orientation - 15/33
Length/Width - 10,000 x 150
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: Runway lights available, NDB

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: Masroor Air Force Base (also known as Mauripur)

Location: (City) (Geo. Coordinates)
Karachi N 2454.0 / E 06657.0

Temperature Data: N/A Field Elevation:

Runways:	Orientation -	04/22	09/27
	Length/Width -	9,000 x 200	9,000 x 115
	Surface Type/Strength -	Asphalt	Concrete

NAVAIDS/Lighting: 04/22 - portable lights and strip lights
09/27 - portable, strip, HIRL and VASI, control
tower-approach control, TACAN, NDB, UHF/DF-Homer,
ILS/Radar

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Grade 100 low lead-Blue; Jet B. Oxygen: Low and
high pressure; liquid oxygen; oxygen replacement
bottles - cylinders

Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: Walton (Air Force/Army Station)

Location:	(City)	(Geo. Coordinates)
	Lahore	N 3130.0 / E 07423.0

Temperature Data:	N/A	Field Elevation:	697 ft. MSL
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Runways:	Orientation -	14/32
	Length/Width -	6,230 x 150
	Surface Type/Strength -	Concrete

NAVAIDS/Lighting: Portable lights

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Jet A-1
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: (Air Force Base)

Location: (City) (Geo. Coordinates)
Mianwali N 3233.8 / E 07134.4

Temperature Data: N/A Field Elevation: 690 ft. MSL

Runways: Orientation - 06/24
Length/Width - 10,150 x 100
Surface Type/Strength - Asphalt/Concrete

NAVAIDS/Lighting: Portable lights - flares; NDB; UHF/DF-Homer; Control Tower

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Jet A-1 (JP-4 Mil. Spec.)
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: (Air Force Base)

Location: (City) (Geo. Coordinates)
Murid N 3254.7 / E 07246.5

Temperature Data: N/A Field Elevation: 1,772 ft. MSL

Runways: Orientation - 13/31
Length/Width - 8,858 x 98
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: Runway; Approach and VASI

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments: Can accept heavy jets

PAKISTAN AIRPORTS

Airport Name/Code: Dhamial Army Base

Location: (City) (Geo. Coordinates)
Qasim N 3333.7 / E 07301.9

Temperature Data: N/A Field Elevation: 1,642 ft. MSL

Runways:	Orientation -	09.27	14/32
	Length/Width -	3,300 x 150	6,690 x 150
	Surface Type/Strength -	Asphalt	Asphalt

NAVAIDS/Lighting: Runway lights; Control Tower; NDB

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Grade 100 low lead-Blue; Jet fuel
Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: Shorkot Road Air Force Base

Location: (City) (Geo. Coordinates)
Rafiqui N 3045.8 / E 07117.0

Temperature Data: N/A Field Elevation: 492 ft. MSL

Runways: Orientation - 15/33
Length/Width - 10,000 x 160
Surface Type/Strength - Asphalt

NAVAIDS/Lighting: NDB

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available -
Storage Volume -
Delivery System -

Based Aircraft: Types Number

Special Features or Comments:

PAKISTAN AIRPORTS

Airport Name/Code: (Air Force Base)

Location: (City) (Geo. Coordinates)
Sargodha N 3203.0 / E 07240.0

Temperature Data: N/A Field Elevation: 614 ft. MSL

Runways:	Orientation -	05/23	14/32
	Length/Width -	7,940 x 140	10,050 x 150
	Surface Type/Strength -	Asphalt	Asphalt

NAVAIDS/Lighting: 05/23 - Runway lights
14/32 - Approach; HIRL; High Intensity Approach
Lights; VASI; TACAN; VHF/UHF/DF; ILS/Radar; Control
Tower; Approach Control

Maintenance Facilities:

Operator -
Services Available -

Fuel Facilities:

Types Available - Jet JP-4; 100 grade low lead-Blue, Oxygen various
type and some maintenance facilities

Storage Volume -
Delivery System -

Based Aircraft:	<u>Types</u>	<u>Number</u>
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Special Features or Comments:

Decade in Statistics

OPERATION

	1982-83	1981-82	1980-81	1979-80	1978-79	1977-78	1976-77	1975-76	1974-75	1973-74
Route Kilometres	204,954	192,216	205,996	218,828	203,895	185,369	164,315	148,569	147,095	113,970
Revenue Kilometres Flown (000)	45,232	45,337	48,962	50,298	53,108	42,909	36,070	33,931	28,629	23,784
Revenue Hours Flown	87,030	83,879	90,126	91,618	95,801	79,453	68,190	63,472	52,542	44,981
Available Tonne Kilometres (000)	1,473,110	1,464,569	1,548,816	1,415,647	1,305,053	1,151,363	986,820	802,910	667,108	429,400
Available Seat Kilometres (000)	9,914,056	9,785,181	10,152,030	8,981,508	7,923,919	7,319,164	6,439,483	5,263,770	4,027,773	2,926,276

TRAFFIC

Revenue Passengers Carried (000)	3,408	3,202	3,136	2,853	2,693	2,556	2,129	1,634	1,251	925
Revenue Passengers Kilometres (000)	6,659,327	6,246,326	6,039,971	5,180,272	4,805,837	4,413,547	3,758,504	2,936,259	2,231,928	1,593,558
Passenger Load Factor	67.2%	63.8%	59.5%	57.7%	61.3%	60.3%	58.4%	55.8%	55.4%	54.5%
Revenue Freight Tonne Kilometres (000)	232,585	236,331	245,395	228,404	215,034	181,094	152,048	135,298	120,521	73,081
Kgs. of Excess Baggage & Cargo (000)	83,241	79,818	74,389	65,177	63,103	52,639	45,785	36,833	30,955	23,281
Kgs. of Mail (000)	2,739	2,480	2,524	2,151	2,099	2,044	1,838	1,608	1,556	1,487
Revenue Tonne Kilometres (000)	846,950	816,108	804,851	706,517	655,343	583,503	492,781	398,553	319,357	215,389
Revenue Load Factor	57.6%	55.7%	52.0%	49.9%	50.4%	50.7%	49.9%	49.6%	47.9%	50.2%
Avg. Pax Stage Distance (Statute Kilometres)	1,954	1,951	1,926	1,816	1,784	1,727	1,765	1,797	1,784	1,723

FINANCIAL

Operating Revenue (Rs. in Millions)	7,702.43	6,559.35	6,068.65	4,845.58	3,753.57	3,061.98	2,473.39	1,929.66	1,519.25	1,004.57
Operating Expenses (Rs. in Millions)	7,261.46	6,335.75	5,997.88	4,772.44	3,457.89	2,791.22	2,321.31	1,875.18	1,498.60	1,004.39
Operating Surplus (Rs. in Millions)	440.97	223.60	70.97	73.14	305.68	270.76	152.08	54.48	20.65	0.18
Cost per A.T.K. (Rs.)	4.929	4.328	3.873	3.371	2.548	2.424	2.352	2.335	2.246	2.339

PERSONNEL

Average Number of Employees	20,017	21,918	23,548	22,813	21,201	19,469	17,776	16,193	14,352	12,930
Revenue per Employee (Rs.)	384,794	299,268	257,723	212,404	177,330	157,275	139,142	119,166	105,856	77,693
A.T.K. per Employee	73,593	66,820	65,773	62,054	61,503	59,138	55,514	49,584	46,482	33,210

Balance Sheet as at 30 June, 1983

(US\$ 000's)	(Rs. 000's)			(US\$ 000's)			(Rs. 000's)		
1983	Note	1983	1982	Note	1983	1982	Note	1983	1982
SHARE CAPITAL & RESERVES									
Share Capital									
380,477	3	5,000,000	1,500,000		678,441		10	8,915,664	8,169,005
100,632		1,322,446	1,225,353		248,416			3,264,529	2,700,197
100,632		1,322,446	1,225,353		430,025			5,651,135	5,468,608
100,632		1,322,446	1,225,353		1,046		11	13,747	103,387
110,015	4	1,445,750	1,388,680		6,677			87,749	102,740
21,531		262,957	88,181		12,905		12	169,583	160,975
232,178		3,051,153	2,702,214						
244,815	5	3,217,209	3,028,940						
LONG-TERM DEBTS									
DEFERRED LIABILITIES									
—		—	66,619		63,643		13	836,360	905,215
7,610	2(i)	100,000	—		89,384		14	1,174,639	1,215,513
7,610		100,000	66,619		18,014		15	236,726	355,421
CURRENT LIABILITIES									
50,240		660,227	611,743		4,957		16	55,137	58,106
7,472	6	98,195	120,923		76,619		17	1,006,679	270,730
7,391		97,128	252,596		252,617			3,319,741	2,602,985
61,155	7	803,669	961,251						
1,130		14,850	12,905						
84,392		1,109,029	831,821						
5,698		74,871	34,459						
217,478		2,857,969	2,825,498						
LIABILITIES IN BANGLADESH & INDIA									
1,189	8	15,624	15,624						
CONTINGENT LIABILITIES & COMMITMENTS									
703,270	9	9,241,955	8,638,895		703,270			9,241,955	8,638,895

M. R. KHAN
Director

D. M. QURESHI
Director

Profit and Loss Account for the year ended 30 June, 1983

(US\$ 000's)			(Rs. 000's)	
1983		Note	1983	1982
REVENUE				
561,903	Traffic & maintenance	18	7,384,187	6,259,461
24,216	Other revenue	19	318,238	299,888
<u>586,119</u>			<u>7,702,425</u>	<u>6,559,349</u>
EXPENDITURE				
464,346	Flying & maintenance	20	6,102,159	5,188,386
57,036	Depreciation	21	749,538	602,502
31,181	Interest	22	409,761	544,859
<u>552,563</u>			<u>7,261,458</u>	<u>6,335,747</u>
33,556	OPERATING SURPLUS		440,967	223,602
(92)	Profit/(loss) on disposal of fixed assets		(1,209)	2,412
(3,805)	Provision for staff bonus		(50,000)	(25,000)
(1,483)	Workers' share of profit		(19,488)	(10,051)
<u>28,176</u>			<u>370,270</u>	<u>190,963</u>
—	Prior years' adjustments		—	(248,116)
<u>28,176</u>			<u>370,270</u>	<u>(57,153)</u>
7,610	Provision for deferred taxation		100,000	—
149	Prior years' taxation		1,958	3,926
<u>7,759</u>			<u>101,958</u>	<u>3,926</u>
20,417			268,312	(61,079)
6,710	Profit brought forward		88,181	182,440
<u>27,127</u>			<u>356,493</u>	<u>121,361</u>
11	Transfer to reserves		149	43
5,585	Proposed dividend	23	73,387	33,137
<u>5,596</u>			<u>73,536</u>	<u>33,180</u>
<u>21,531</u>			<u>282,957</u>	<u>88,181</u>

Karachi, 29 October, 1983

M. R. KHAN
Director

D. M. QURESHI
Director

Appendix A
Financial Data
Pakistan International Airlines

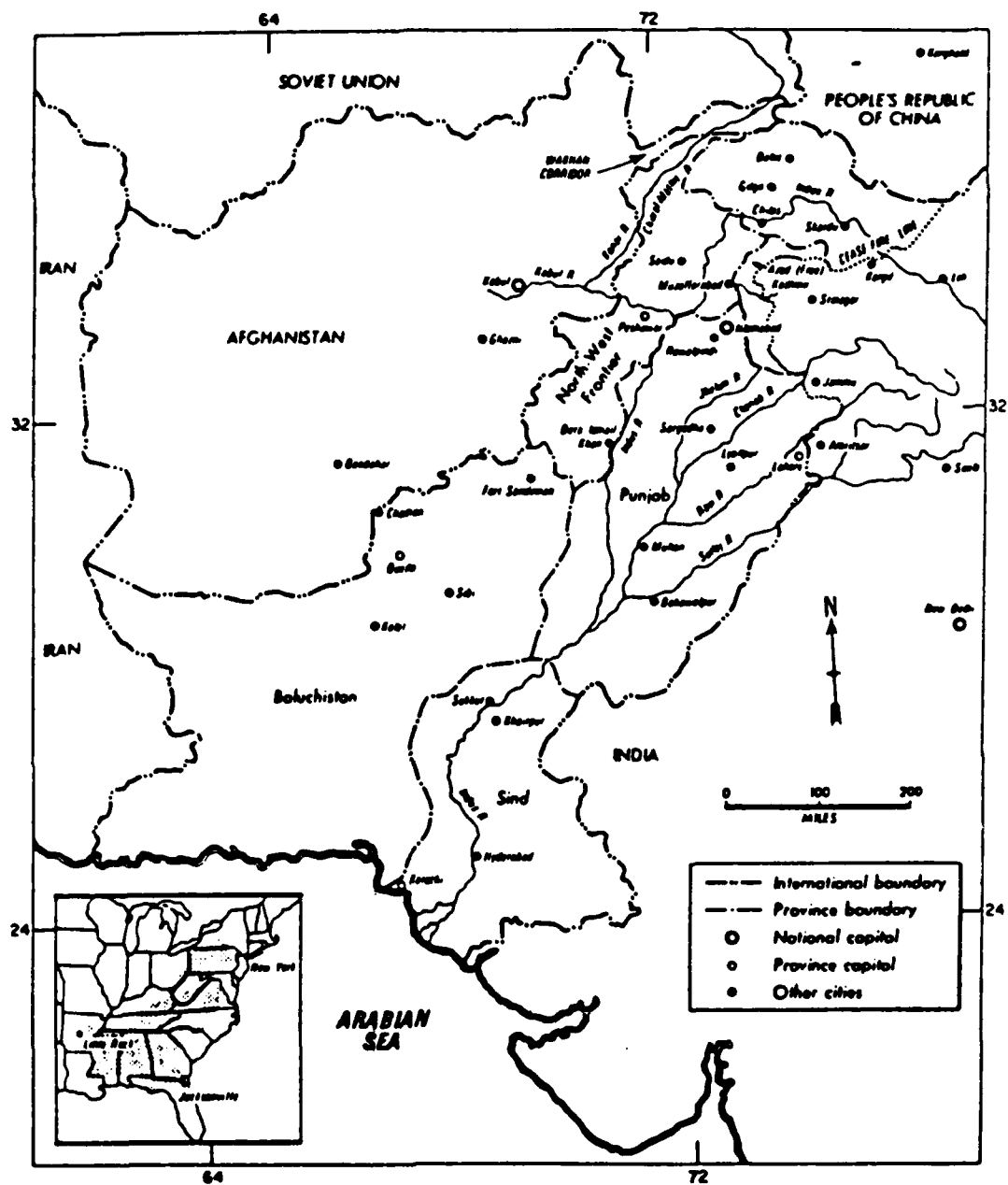


Figure 11. POLITICAL MAP OF PAKISTAN

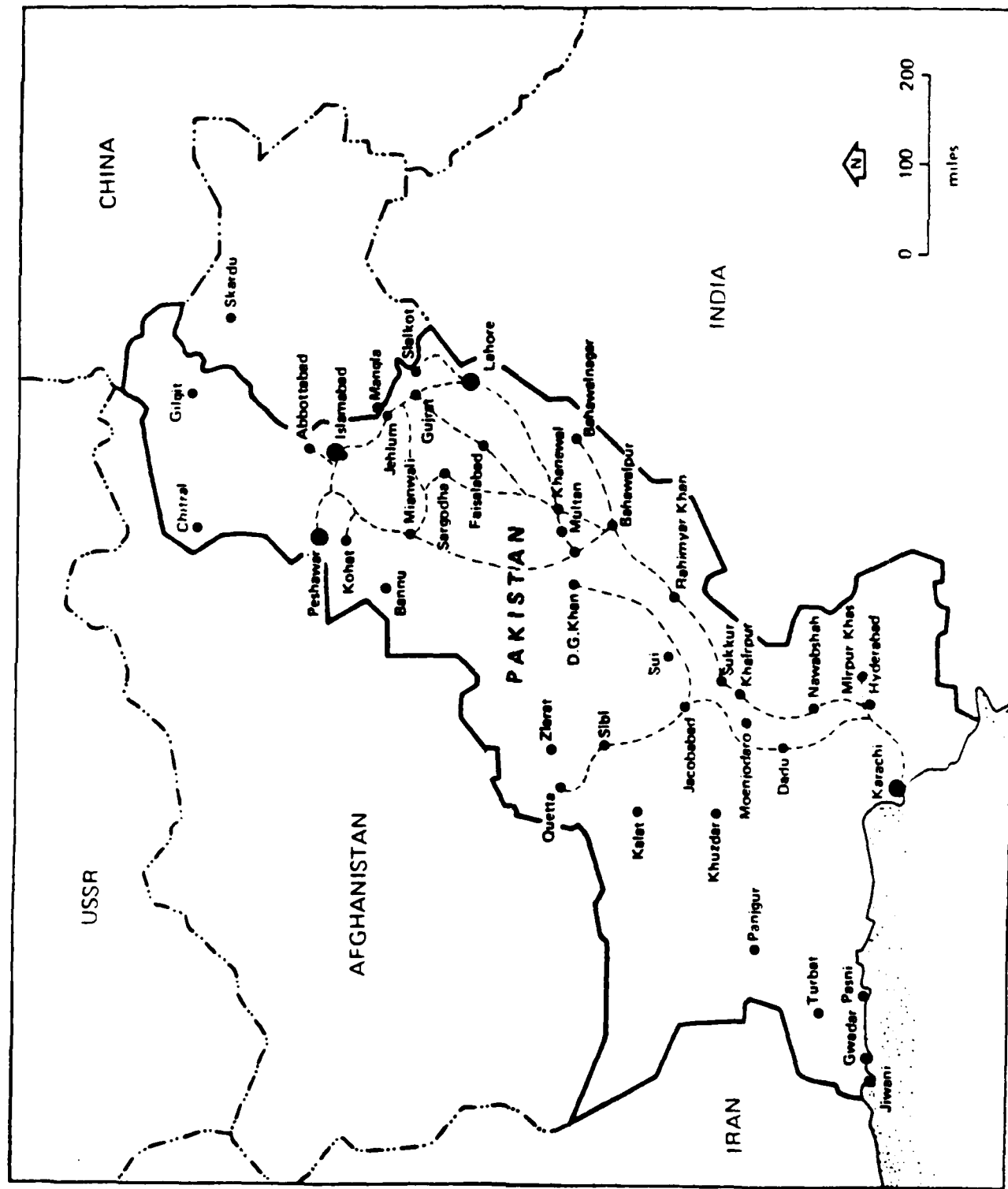


Figure 9. PAKISTAN RAILWAY SYSTEM

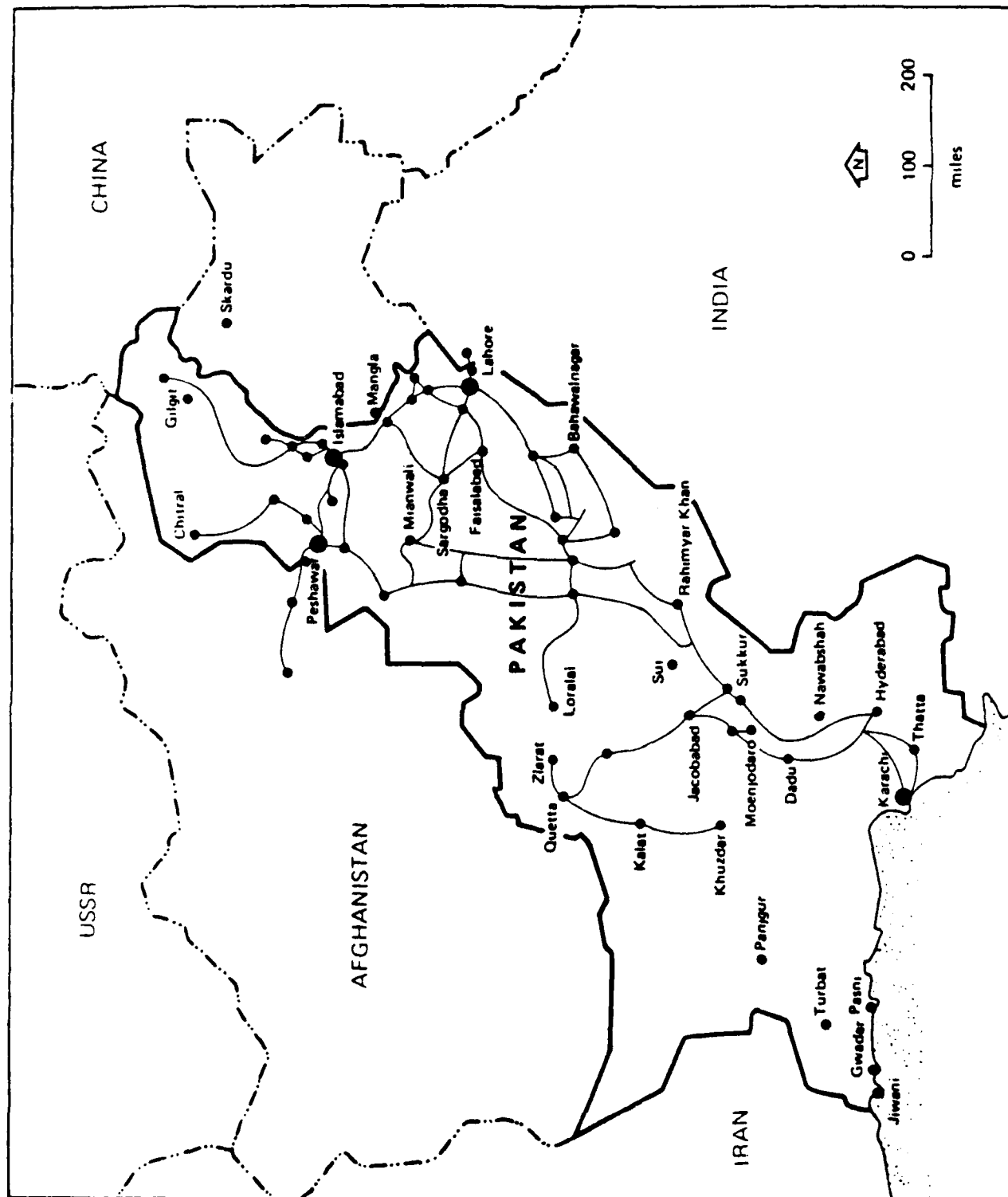


Figure 10. PAKISTAN MAJOR HIGHWAY SYSTEM

Aircraft Type: McDonnell Douglas DC-10

Models: -30

Engines: Three General Electric CF6-50C

Dimensions: Wing Span 165 ft. 4.4 in. Length 182 ft. 1 in. Height 58 ft. 1 in.

Weights (lbs): MTOW 572,000 Empty 267,197 MAX WD 403,000 MAX PYLD 106,550 Fuel Cap. 244,550

Seats: Maximum 380 Typical 255

Cargo Capability: with lower galley 3,696 cu. ft.
with upper galley 5,490 cu. ft.

Maximum Range - With Maximum Payload: 4,000 n. mi.

Runway Requirements: Balanced Field Length - 10,400 ft.
Minimum Runway Length - 5,350 ft.
Minimum Runway Bearing Strength - N/A

Special Features or Restrictions: Limited cargo capability.

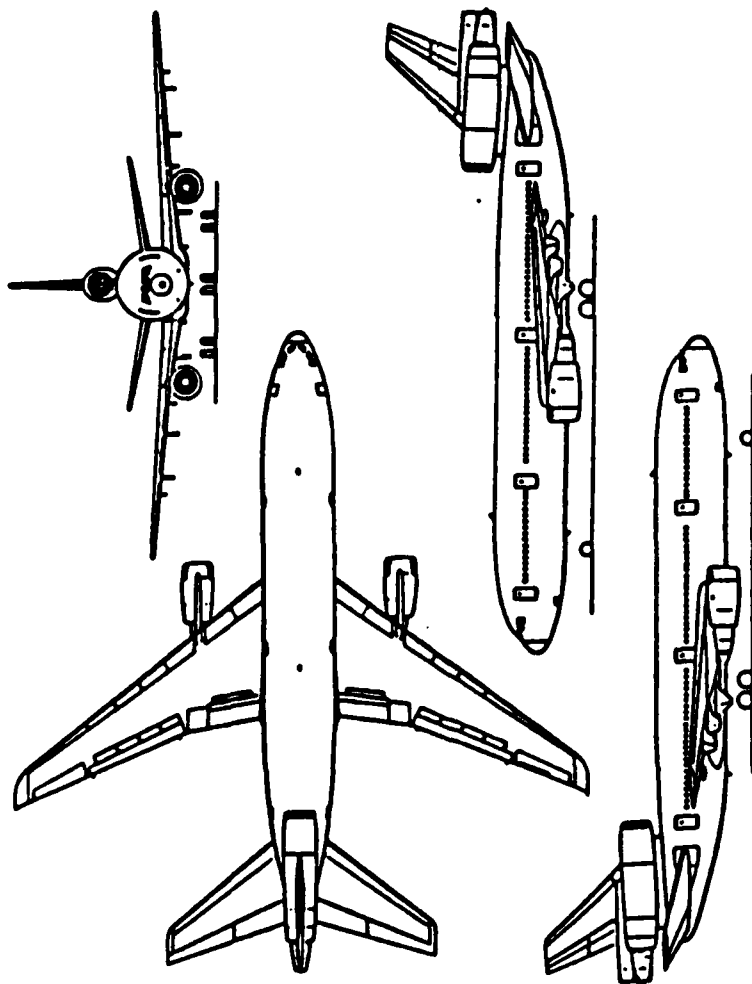


Figure 7. GENERAL AIRCRAFT DATA-DC-10

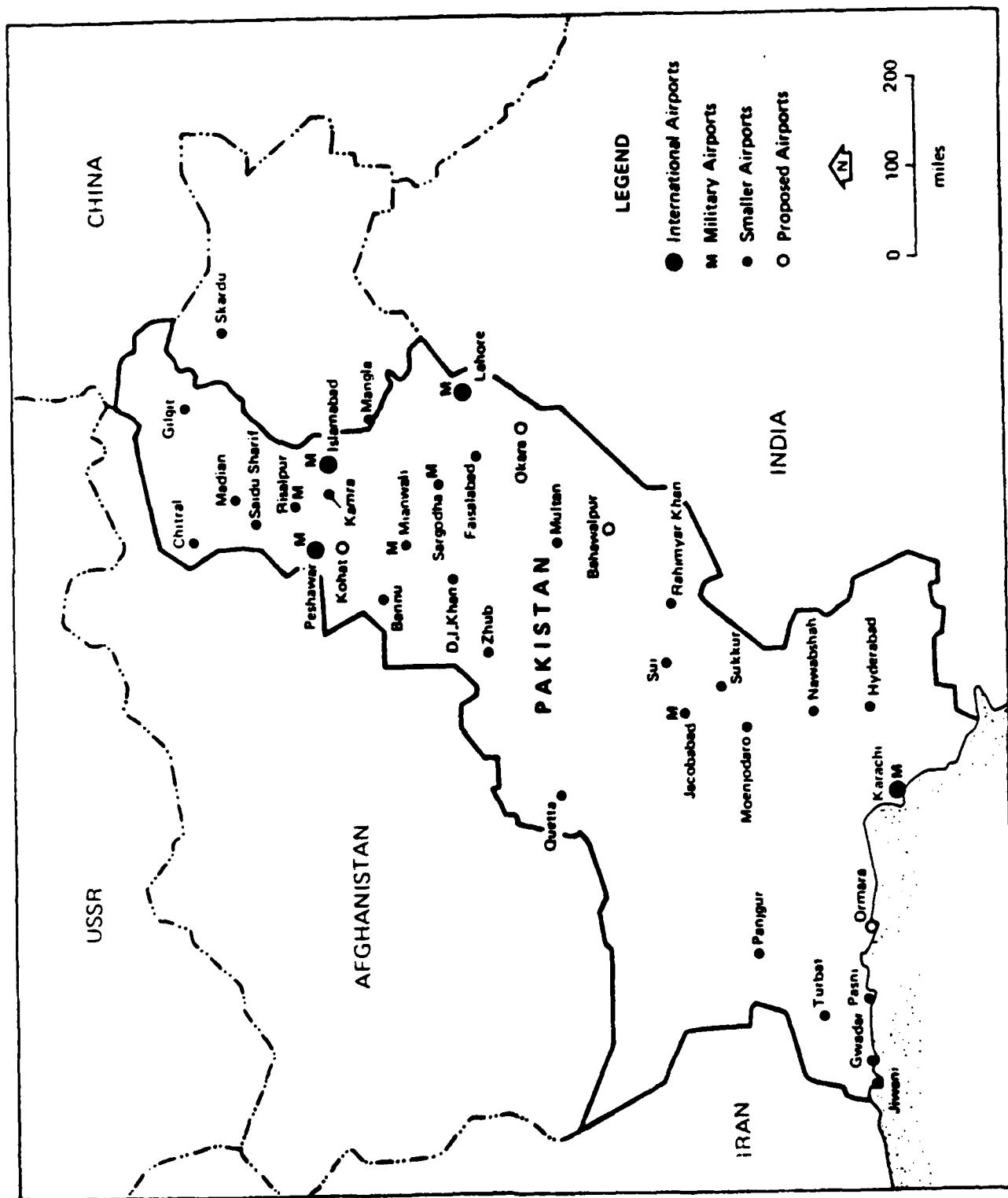


Figure 8. PAKISTAN CIVIL AND MILITARY AIRPORTS

Aircraft Type: Boeing 747

Models: -282B/-230B Combi/-240B Combi

Engines: General Electric CF6-50E2

Dimensions: Wing Span 195 ft. 8 in. Length 231 ft. 10 in. Height 63 ft. 5 in.

Weights (lbs):	MAXOW	Empty	MULNO	MPVLD	Fuel Cap.
B	820,000	386,000	585,000	140,500	351,140
B Combi	820,000	386,000	585,000	160,000	351,140

Seats:	Maximum	Typical
B	480	452
B Combi	266 + 12 pallets	238 pax + 12 pallets

Cargo Capability: 6,190 cu. ft. in passenger version
14,170 cu. ft. in Combi version with 12 pallets

Maximum Range - With Maximum Payload: 5,200 n. mi.

Runway Requirements: Balanced Field Length - 10,820 ft.
Typical Minimum Runway Length - 6,000 ft.
Minimum Runway Bearing Strength - 88 LCN

Special Features or Restrictions: Except for its size, which results in a requirement for long, reinforced runways, the B747 in the Combi configuration is an ideal aircraft for some military roles. This is largely because of its versatility and large payload capability.

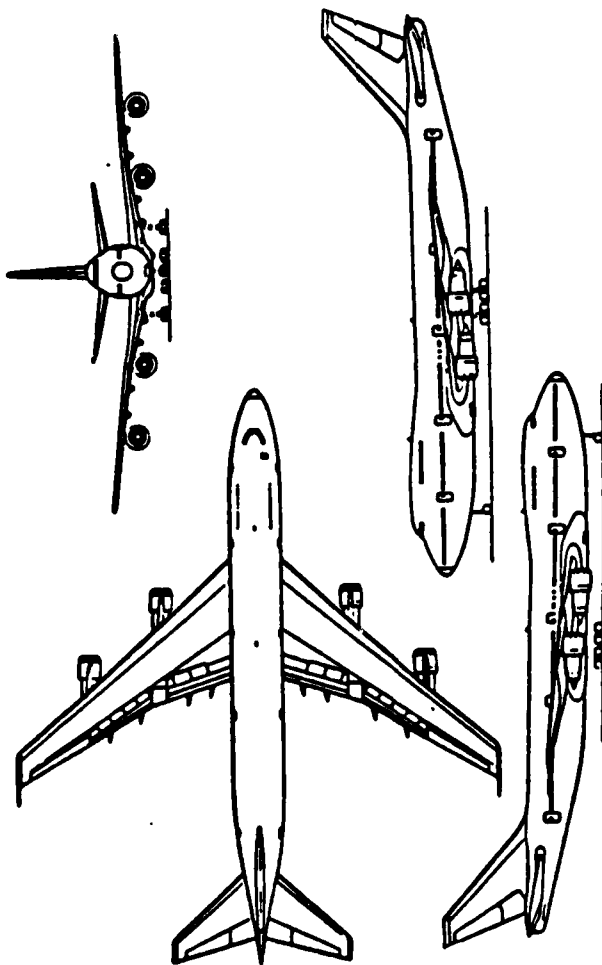


Figure 5. GENERAL AIRCRAFT DATA--BOEING 747

Aircraft Type: Fokker F27

Models: -200/-400

Engines: Two Rolls Royce Dart 532-7

Dimensions: Wing Span 95 ft. 2 in. Length 77 ft. 3.5 in. Height 27 ft. 11 in.

Weights (lbs):	MTOU	Empty	MIL MD	MRPYLD	Fuel Cap.
-200	45,000	25,525	41,000	13,020	9,090
-400	45,000	24,720	41,000	14,193	9,090

Seats: Maximum 48
-200 46 para troopers
-400

Cargo Capability: 269 cu. ft.

Maximum Range - With Maximum Payload: -200 3,197 n. mi.
-400 (military transp.) 2,727 n. mi.

Runway Requirements: Balanced Field Length - 3,240 ft.
Minimum Runway Length - 2,310 ft.
Minimum Runway Bearing Strength - 15 LCM

Special Features or Restrictions: The F27 is capable of operation on grass, dirt, or gravel runways. While the F27-600 has a larger cargo door, these -200 and -400 models do not have it and are less suitable for cargo.

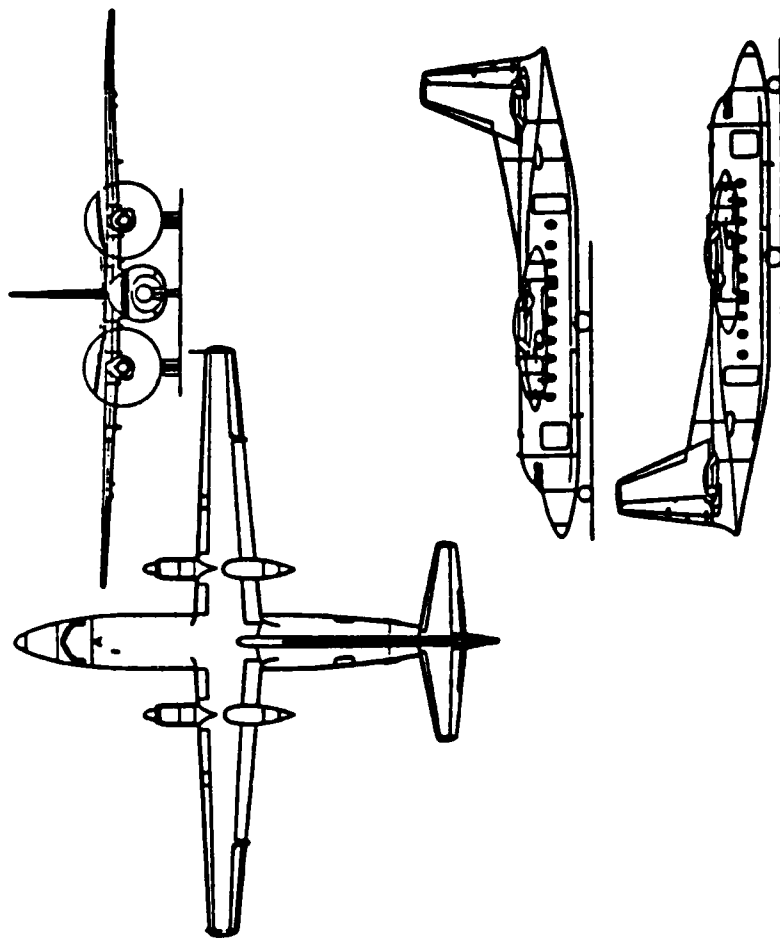


Figure 6. GENERAL AIRCRAFT DATA-FOKKER F27

Aircraft Type: Airbus Industrie A300

Models: BA-203

Engines: Two General Electric CF6-50C2

Dimensions: Wing Span 147 ft. 1 in. Length 175 ft. 11 in. 54 ft. 2-3/4 in. Height

Weights (lbs): MTOW 363,760 Empty 176,000 MLWD 295,420 MXPYLD 77,602 Fuel Cap. 104,720

Seats: Maximum 336 Typical 269

Cargo Capability: Volume 3,565 cu. ft. in belly

Maximum Range - With Maximum Payload: 2,900 n. mi.

Runway Requirements: Balanced Field Length - 9,750 ft.
Minimum Runway Length - 5,445 ft.
Minimum Runway Bearing Strength - 74 LCN

Special Features or Restrictions: This version of the A300 is not convertible to an all-cargo configuration and could be used only as a personnel transport in a military role.

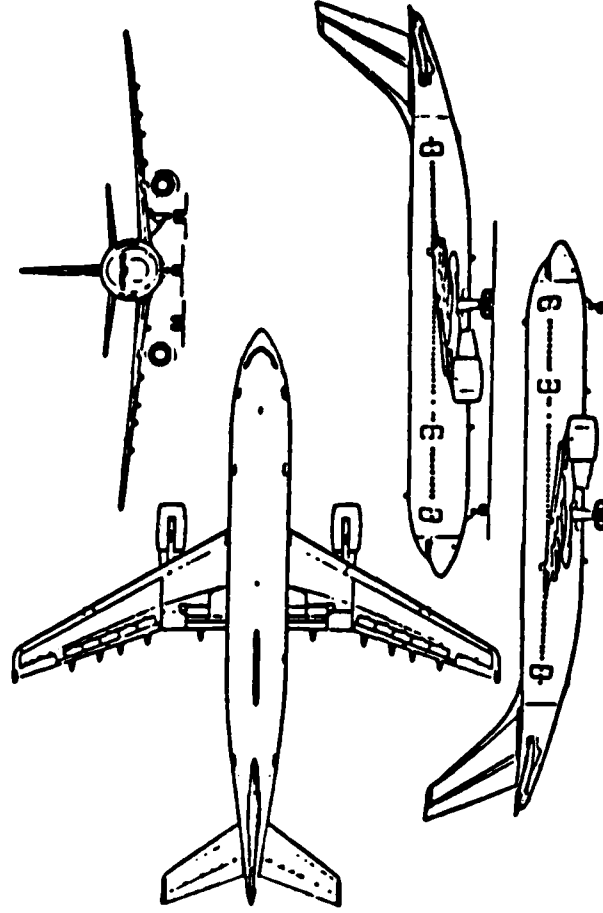


Figure 3. GENERAL AIRCRAFT DATA--AIRBUS A300B4

Aircraft Type: Boeing 707

Models: -373C/-340C/-351B/-323C

Engines: Four Pratt and Whitney JT3D-3B

Dimensions: Wing Span 145 ft. 9 in. Length 152 ft. 11 in. Height 41 ft. 7 in.

Weights (lbs.):	Empty	MLMD	MUPYLD	Fuel Cap.
-320B	140,000	207,000	50,000	166,529
-320C	136,000	247,000	96,000	166,529

Seats: Maximum 189 Typical 121

Cargo Capability: Volume 1,700 cu. ft. in belly
8,000 cu. ft. on upper deck
96,000 lbs. maximum

Maximum Range - With Maximum Payload: -320B - 6,160 mi.
-320C - 4,235 mi.

Runway Requirements:	B	C
Balanced Field Length -	10,720 ft.	11,220 ft.
Typical Minimum Runway Length -	8,000 ft.	8,000 ft.
Minimum Runway Bearing Strength -	N/A	N/A

Special Features or Restrictions: These aircraft will not be permitted to operate in many areas of the world such as the United States and Europe after 1965, when ICAO noise regulations become effective. Individual countries, such as Bangladesh, may elect to override the ICAO regulations in their own country.

The -321B model is a strictly passenger version of the B707. Its military role would be limited to troop transport plus belly cargo. The -351C and -369C models are convertibles which can be used in either cargo or passenger configuration.

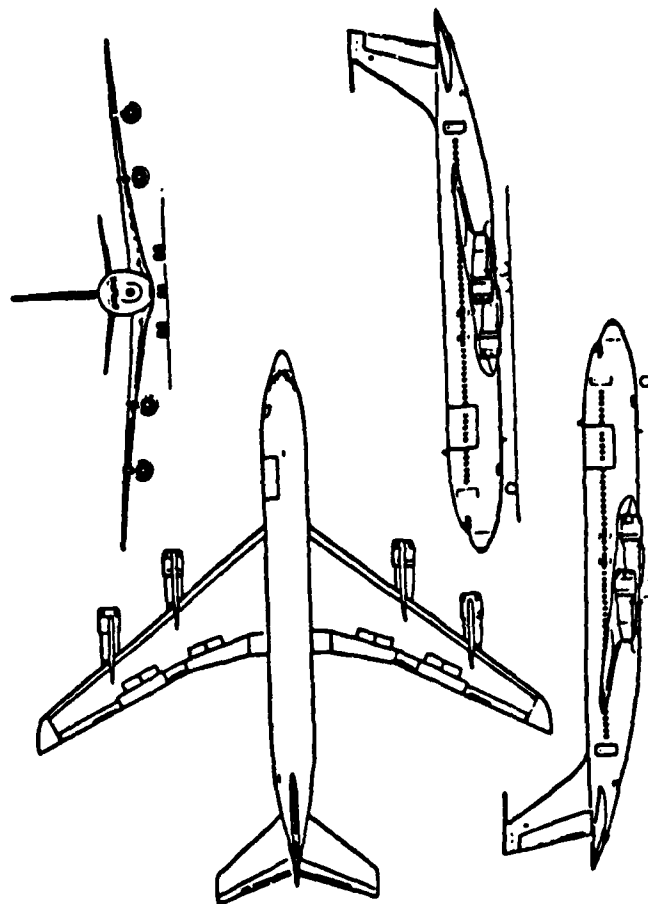


Figure 4. GENERAL AIRCRAFT DATA-BOEING 707

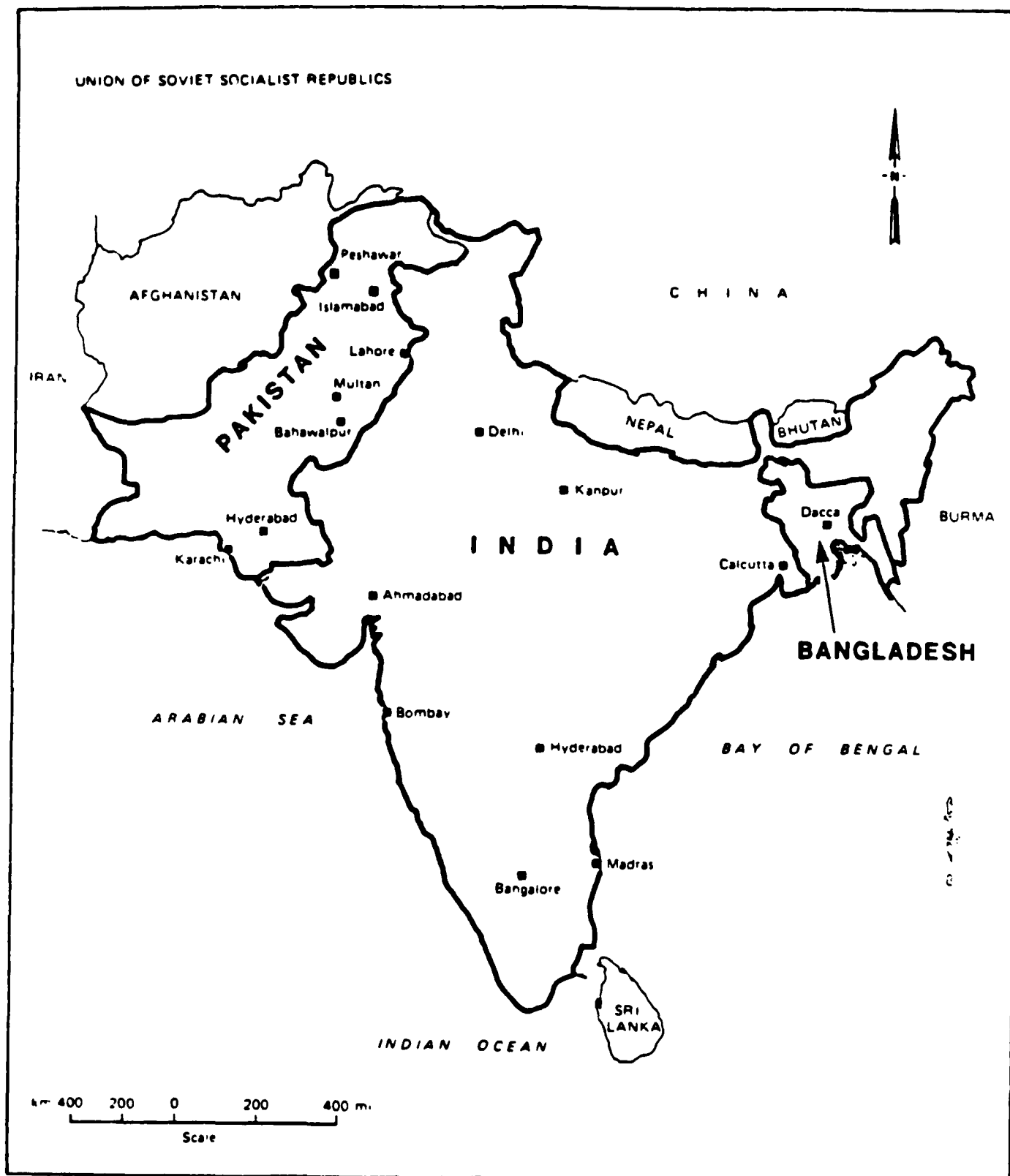


Figure 1. LOCATION MAP, BANGLADESH, INDIA AND PAKISTAN

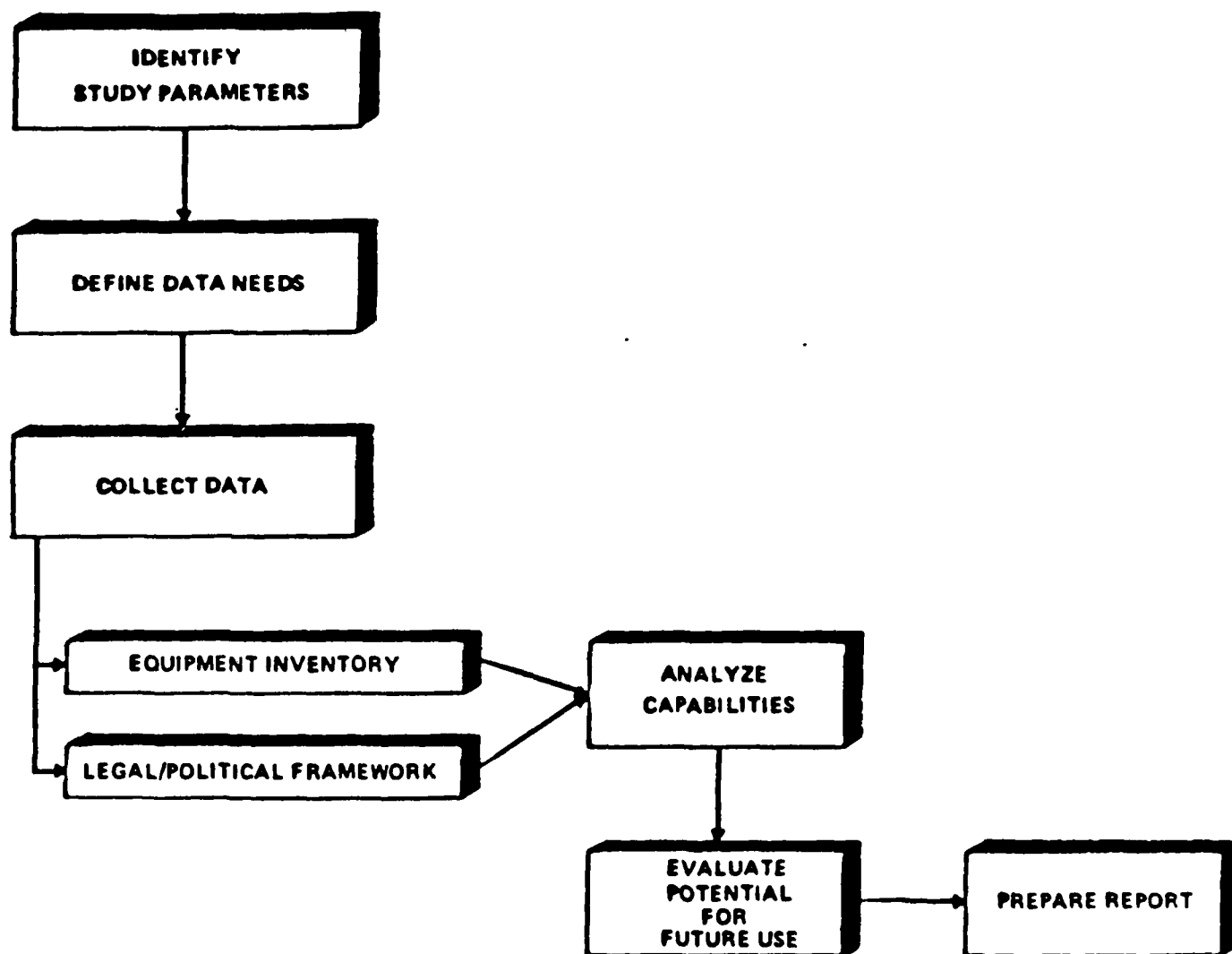


Figure 2. RESEARCH METHODOLOGY

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